Economic Interrelationships in a Small Farming Area:

Towards an Estimate of the Threshold of Agricultural Production for Sustainable Farming

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1. Introduction

Urban sprawl and the loss of farmland have been driving forces in determining the American landscape since World War II. Since 1950, the American population has increased 86% (Census, 1997). Over the last two decades this growth has increasingly resulted in the loss of farmland. Through the 1980's and early 1990's, the American Farmland Trust (AFT) reported that an average of 400,000 acres per year of prime farmland was converted to development uses (Sorrenson, Greene, & Russ, 1997). Farmland loss is a concern due to the multitude and variety of services it generates. Farmland benefits the economy directly through employment in agricultural and its related support services. It has many important environmental benefits such as wildlife habitat and groundwater recharge. Additionally, farmland is valued for the open space and other amenities services it provides.

In order to efficiently preserve farmland, policymakers need to fully understand the interrelationships within rural agricultural communities. The agricultural infrastructure is the web of personal, economic, social and legal relationships that support the production of agricultural commodities. It includes, most visibly, agricultural input suppliers and output processors. Additionally, it encompasses the formal and informal business relationships between individual farms. Infrastructure provides access to input and output markets and access to agricultural services ranging from continuing education to consulting. Moreover, it includes institutional arrangements, such as the legal and monetary systems.

The degree of interdependence within the agricultural community can have a significant impact on the performance of farm preservation policies. Farmers can depend on neighboring farms within their communities for many services, including equipment sharing, land renting, custom work, joint irrigation and drainage projects and assistance in times of need. Additionally, this interdependence may also include farmers' joint need for input suppliers and output processors, transportation systems, agricultural consulting and other infrastructure components. Concentrations of producers with these joint needs often generate economies of scale, acquiring services more economically than an isolated producer. As an agricultural community shrinks, it is possible that there will not exist sufficient production to support these related services and economies of scale benefits may be lost.

Without a supportive infrastructure, the agricultural industry may not be able to continue its role as a significant contributor to regional and national economies. If the agricultural service industries find it financially difficult to remain in a region, the farmers left producing may also find it increasingly more difficult to remain in production. This revolving circle of interdependence raises the issue of a critical mass in agriculture.

The critical mass question inherently has two components: 1) dependence between farms; and 2) dependence on local agricultural services. Both components are interrelated and must be understood in order to prescribe appropriate farm preservation policy. The combination of growing urbanization pressures and unique, highly valuable farmland, makes Oregon's Willamette Valley[1] a perfect case study area to examine the critical mass question. American Farmland Trust places the Willamette and Puget Sound Valleys as the fifth most threatened "major land resource area" in the United States (Sorensen et al., 1997). Farming is an important component in the Willamette Valley economy; generating over $1.8 billion in gross farm sales in 2001 and providing support for approximately 24,000 related jobs in agricultural services and food production. Preservation of farmland and the farm economy is imperative to many of the Valley's residents.

This report is intended to increase the understanding of interrelationships in a small farming community. As a pilot project it is expected to create a foundation that will be helpful for future researchers examining the critical mass question. This report consists of three main sections: Section one begins with a historical review of agriculture in the Willamette Valley. Since every agricultural region has unique components it is useful to begin any modeling process with an understanding of the subject at hand. The historical review provides readers and modelers with a broad understanding of the unique components of the agricultural infrastructure and history of production in the region. Section two of the report uses a survey of agricultural producers in Polk County, Oregon

[1] For the purposes of this study, the Willamette Valley includes all land in the following counties: Benton, Clackamas, Lane, Linn, Marion, Multnomah, Polk, Washington, and Yamhill.

to elucidate the degree of dependence between neighboring farms and the size and degree of dependence on the agricultural infrastructure. Section three contains a dynamic simulation model of agricultural land conversion in Polk County, Oregon. The model represents a significant first step towards a modeling framework that can be employed as an educational or policy-guiding instrument.

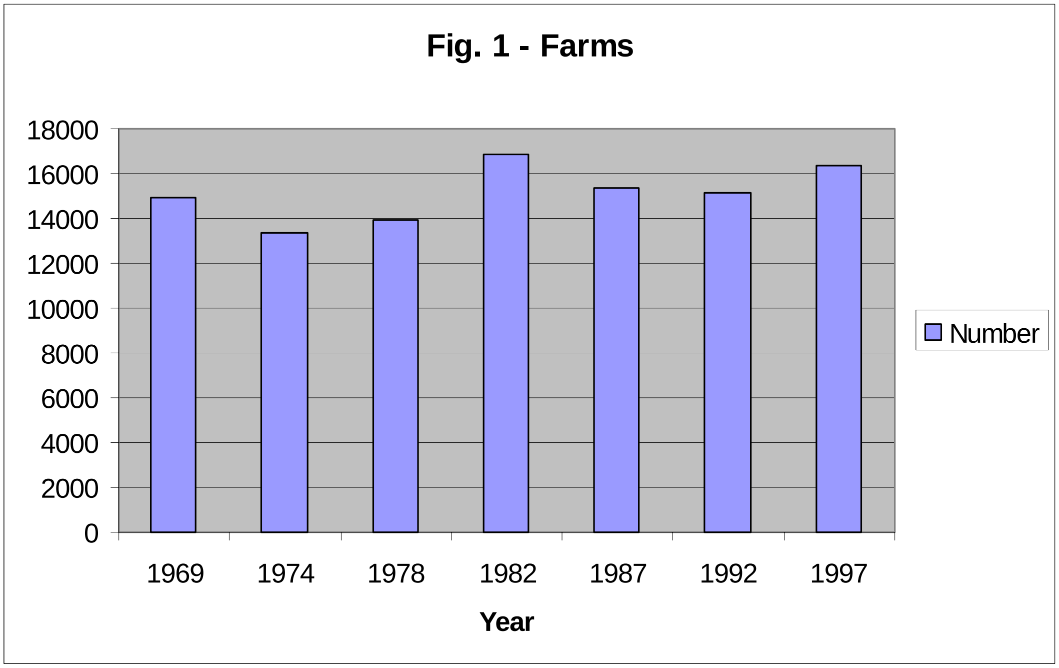
2. Historical Review of Willamette Valley Agriculture

The Willamette Valley is the main population center in Oregon, containing approximately 70 % of the State's total population (Bureau, 1997). As is true in much of the American West, the Valley's population is growing, with a 55% increase since 1970. Moreover, the Valley is world-renowned for its mild climate and productive agricultural soils. The region contains over 16,000 farms with farmland occupying approximately 21% of total land in the nine counties comprising the Valley[2].

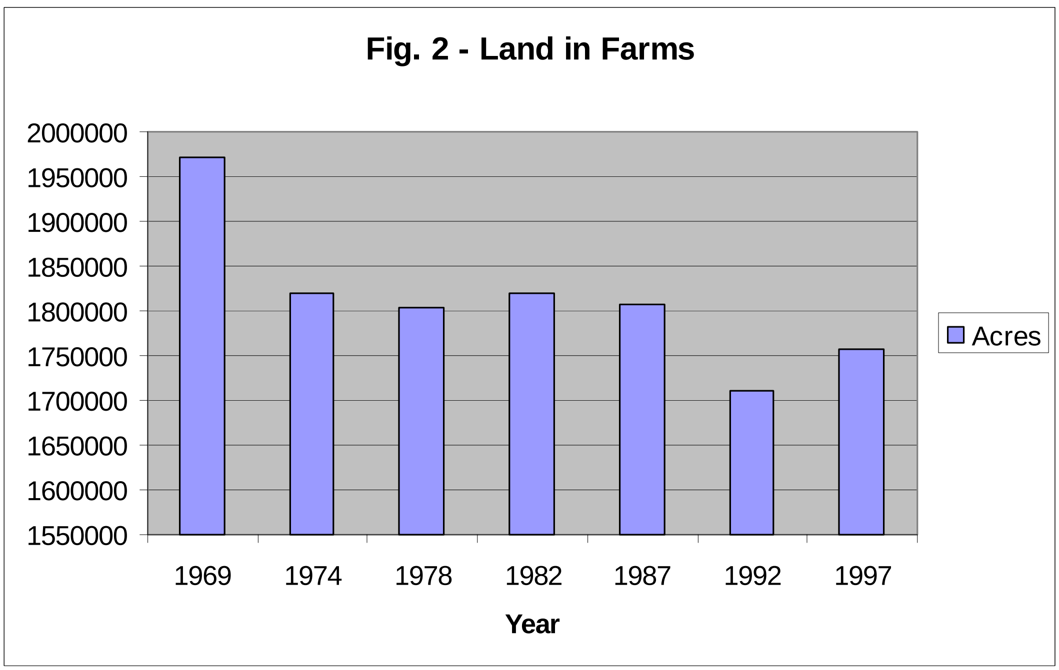
2.1 Farm and Population Trends

The overall number of farms in the Willamette Valley increased by 9.7% between 1969 and 1997 (Figure 1). During this time period, a low of 13,331 was reached in the 1974 Census of Agriculture, and a high of 16,926 farms was reached in the 1982 Census. The story is quite different when considering the total number of acres in farmland. In this case, the trend is clearly declining with a 10.9% decrease in the total acreage in farms between 1969 and 1997 (Figure 2). In 1997 there were approximately 1,756,000 acres in farmland in the valley, comprising 21% of total valley land.

[2] The actual Valley portion of these nine counties is smaller than the total land base, which includes substantial portions of forestland in the Cascades and Coast ranges. As such, this number may be somewhat misleading.

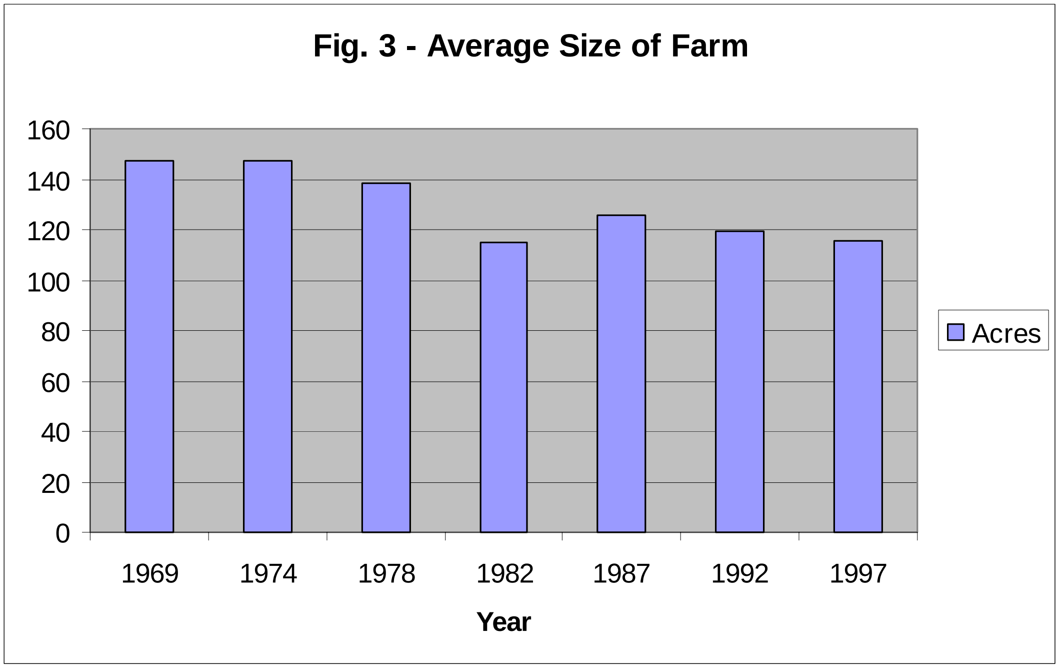


(Source: Census of Agriculture)



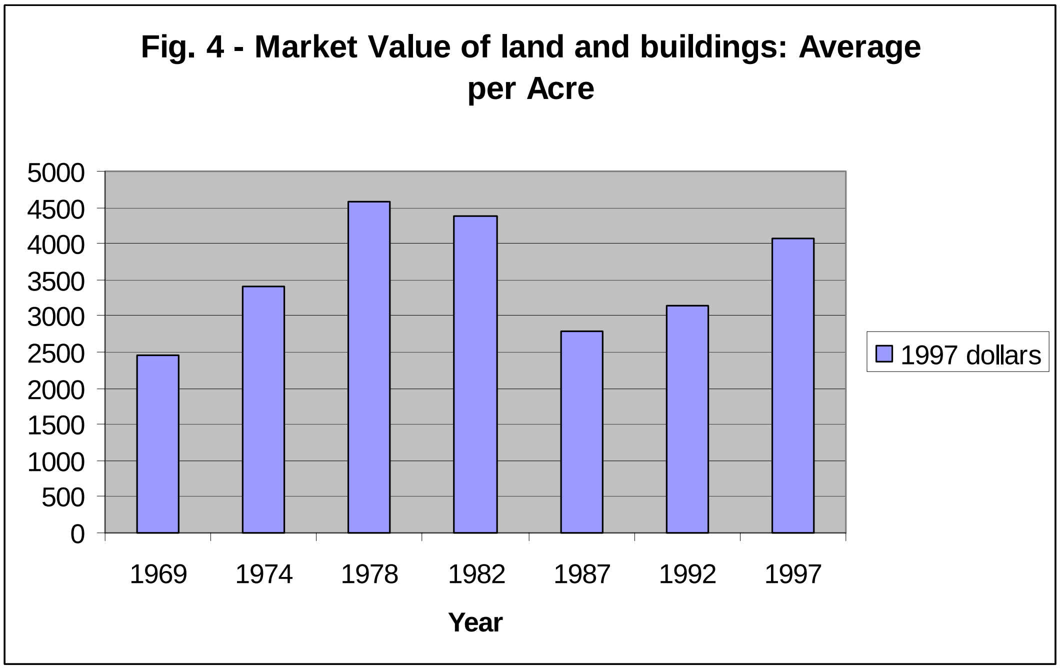
(Source: Census of Agriculture)

Predictably, the loss in aggregate farmland acreage and gain in the number of farms translates into a reduction in the average size of farms, with a 22% decline in average farm size (Figure 3). The average farm size in the most recent Census (1997) was 116 acres, down from a high of 147 acres in 1969.

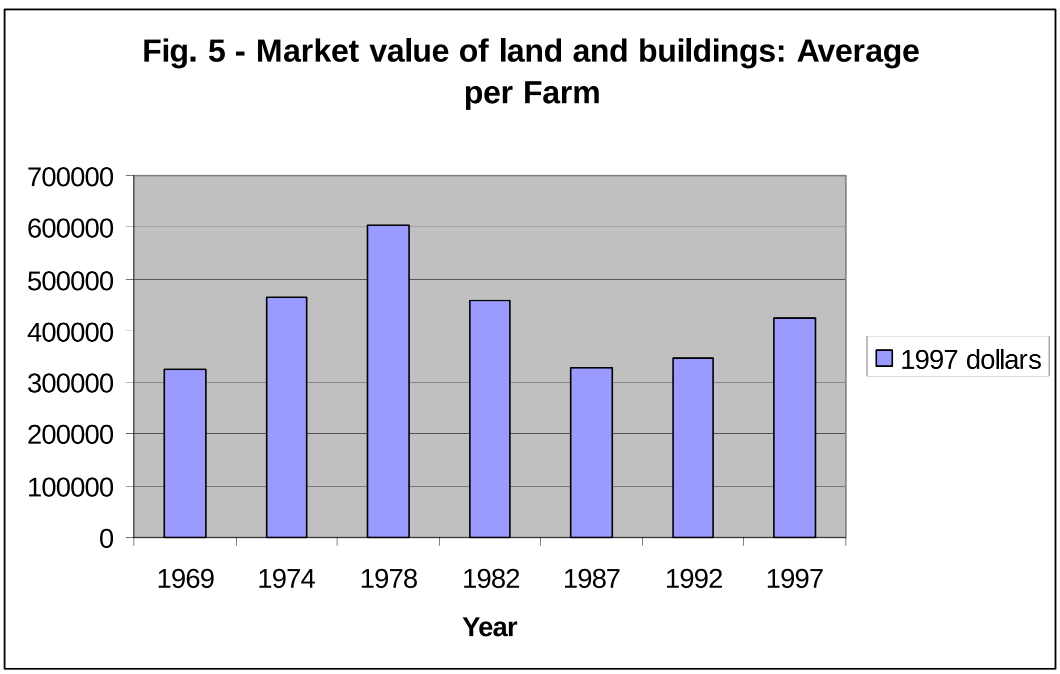


(Source: Census of Agriculture)

In terms of the estimated market value of the land and buildings on farms, there was a 66% increase in value (1997 dollars) between 1969 and 1997 (Figure 4). However, this increase masks considerable variation during the intermediate years. Market value rose steadily between 1969 and 1982, with a high of $4588 per acre in 1982. Then, market value plummeted by 36% during the recession years between 1982 and 1987 before rising steadily to reach $4073 per acre in 1997. The trend is similar when examining market value of land and buildings measured as average per farm (Figure 5). There was a 31% increase in real value between 1969 and 1997, with considerable variability during intermediate years, including a large decline during the early-to-mid 1980s.

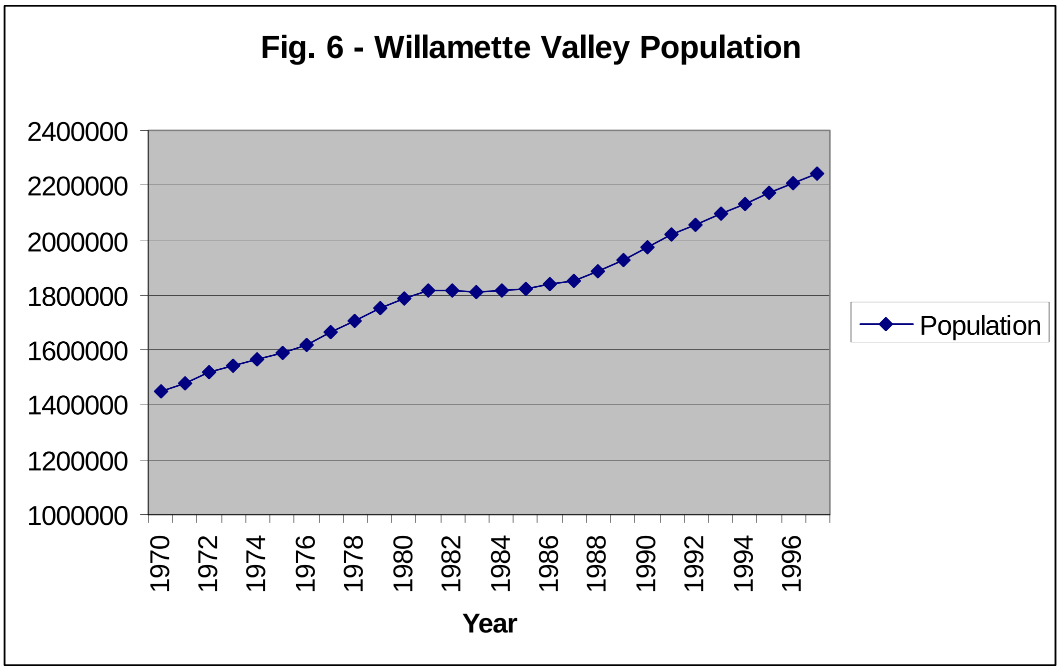


(Source: Census of Agriculture)



(Source: Census of Agriculture)

The decline in the market value of farmland and buildings is closely correlated to changes in population growth in the Valley (Figure 6). After a steady population growth of 23% during the 1970s, the rate of growth leveled off between 1981 and 1986, growing by only 1.3% during this time period. Population growth then resumed at 21% between 1987 and 1997, with a corresponding increase of 46% in the market value of land and buildings per acre. The decline in land values after 1982 also coincides with the implementation of urban growth boundaries as part of Oregon's land use planning program. In addition, strong agricultural export markets during the 1970s may have been partly responsible for driving land values higher.



(Source: U.S. Census Bureau)

2.2 Product Trends

The top-selling crops in the Willamette Valley have changed over time (Table 1). The consistent top-seller for Valley agriculture in recent years has been nursery crops, which have seen a steady increase in share of total Valley agricultural sales from 11.4% in 1982 to nearly 27% in 2001. The only other product to consistently remain in the top five since the late 1970s is dairy products, which constitute between 6-10% of total Valley sales.

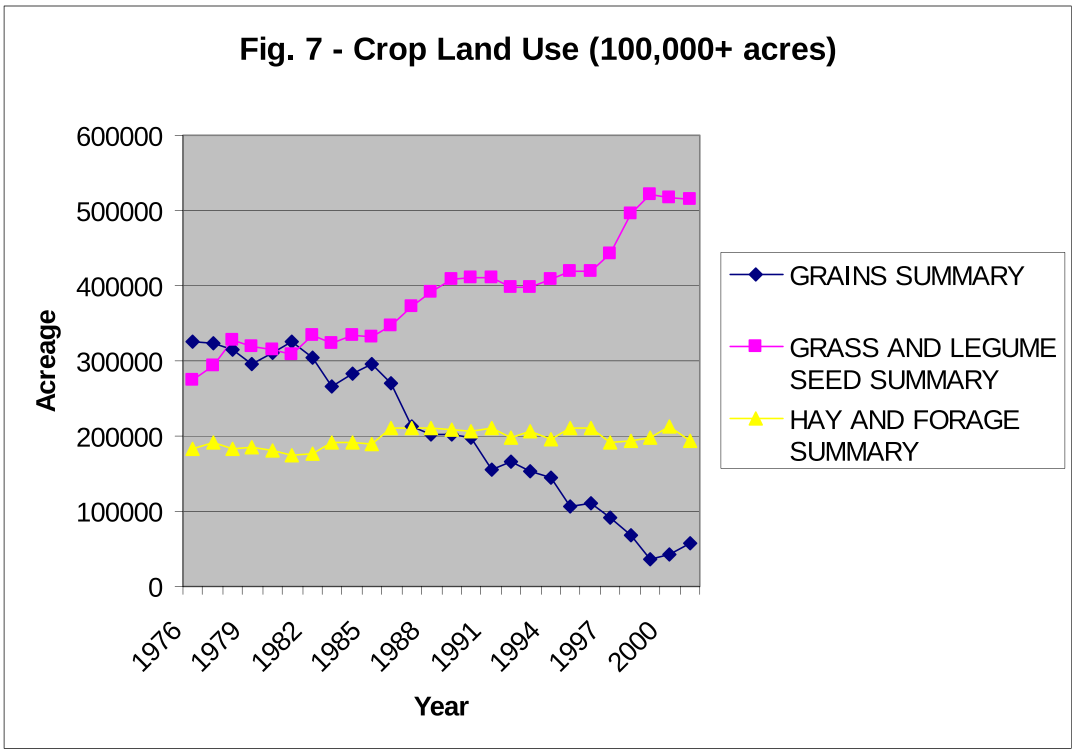
Some noticeable shifts in terms of top-selling products in the Valley include the reduction in the importance of cattle and annual ryegrass since the late 1970s and early 1980s, and the rising importance of greenhouse crops, farm forest products and Christmas trees. Indeed, the increase in sales of nursery and greenhouse crops appears to be the overwhelming success story in Willamette Valley agriculture over the last 25 years. As will be demonstrated later, the high input-intensiveness of these products has strong implications for agricultural infrastructure in the Valley.

Table 1
Top Agricultural Products
(Source: Oregon Agricultural Information Network(OAIN))

1978			**1982**		
Crop	Sales	% of Total	Crop	Sales	% of Total
SPECIALTY HORTICULTURAL	$72,207	15.43%	NURSERY CROPS	$78,155	11.40%
DAIRY PRODUCTS	$47,898	10.24%	DAIRY PRODUCTS	$74,701	10.89%
WHEAT	$35,225	7.53%	WHEAT	$67,703	9.87%
CATTLE	$31,079	6.64%	CATTLE	$41,160	6.00%
ANNUAL RYEGRASS	$22,010	4.70%	ANNUAL RYEGRASS	$29,605	4.32%
1987			**1992**		
Crop	Sales	% of Total	Crop	Sales	% of Total
NURSERY CROPS	$140,600	15.61%	NURSERY CROPS	$245,350	19.16%
DAIRY PRODUCTS	$74,708	8.29%	FARM FOREST PRODUCTS	$135,820	10.60%
FARM FOREST PRODUCTS	$46,244	5.13%	DAIRY PRODUCTS	$100,460	7.84%
PERENNIAL RYEGRASS	$44,503	4.94%	GREENHOUSE CROPS	$57,900	4.52%
CATTLE	$38,075	4.23%	PERENNIAL RYEGRASS	$51,671	4.03%
1997			**2001**		
Crop	Sales	% of Total	Crop	Sales	% of Total
NURSERY CROPS	$350,525	22.40%	NURSERY CROPS	$461,352	26.88%
PERENNIAL RYEGRASS	$126,881	8.11%	GREENHOUSE CROPS	$125,925	7.34%
DAIRY PRODUCTS	$95,080	6.08%	DAIRY PRODUCTS	$125,745	7.33%
FARM FOREST PRODUCTS	$92,694	5.92%	CHRISTMAS TREES	$117,116	6.82%
GREENHOUSE CROPS	$87,600	5.60%	TALL FESCUE	$108,396	6.32%

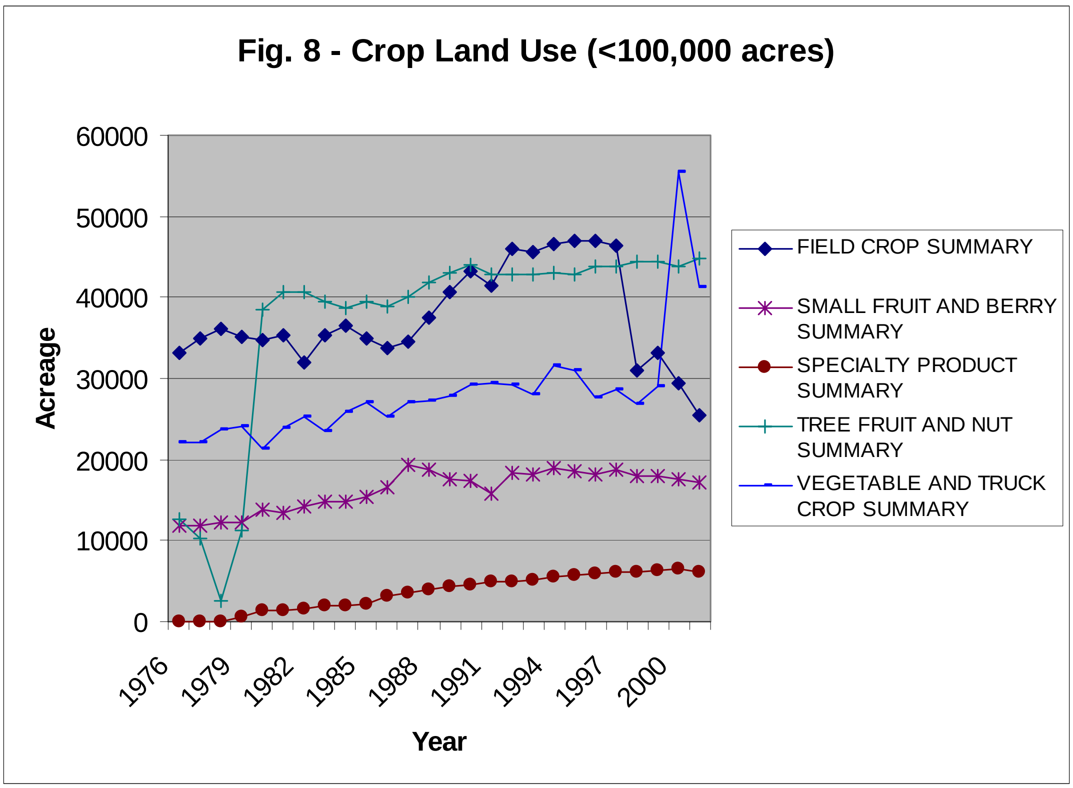
2.3 Land Use Trends in Crops

In terms of land use in crops, several noticeable trends have become apparent since the mid-1970s. The three agricultural categories with more than 100,000 acres of land in the Valley include grains, grass and legume seeds, and hay and forage (Figure 7). The most striking shifts include a loss of 267,000 acres devoted to grains (82% of 1976 acreage), and a gain of 240,000 acres devoted to grass and legume seeds (187% of 1976 acreage). Hay and forage land use has remained fairly stable, hovering around the 200,000 acre mark since 1976.



(Source: OAIN)

For those crops with smaller shares of Valley land use (<100,000 acres), the largest increases since the mid-1970's include a gain of over 32,000 acres (255% of 1976 acreage) devoted to tree fruit and nuts. Additionally, a gain of over 19,000 acres (188% of 1976 acreage) was devoted to vegetable and truck crops (Figure 8). In particular, vegetable and truck crop land use had a large jump of 26,000 acres between 1999 and 2000. This fell on the heels of a large loss of almost 16,000 acres in land devoted to field crops between 1997 and 1998. While the increase in land devoted to tree fruit and nuts between 1976 and 2001 was significant, most of the increase came between 1978 and 1980, when an additional 26,000 acres was devoted to this usage. Small fruit and berry land usage rose steadily between 1976 and 2001, gaining over 5,000 acres in land (145% of 1976 acreage). Also, specialty product land usage grew by more than 6,000 acres during this 25 year span.

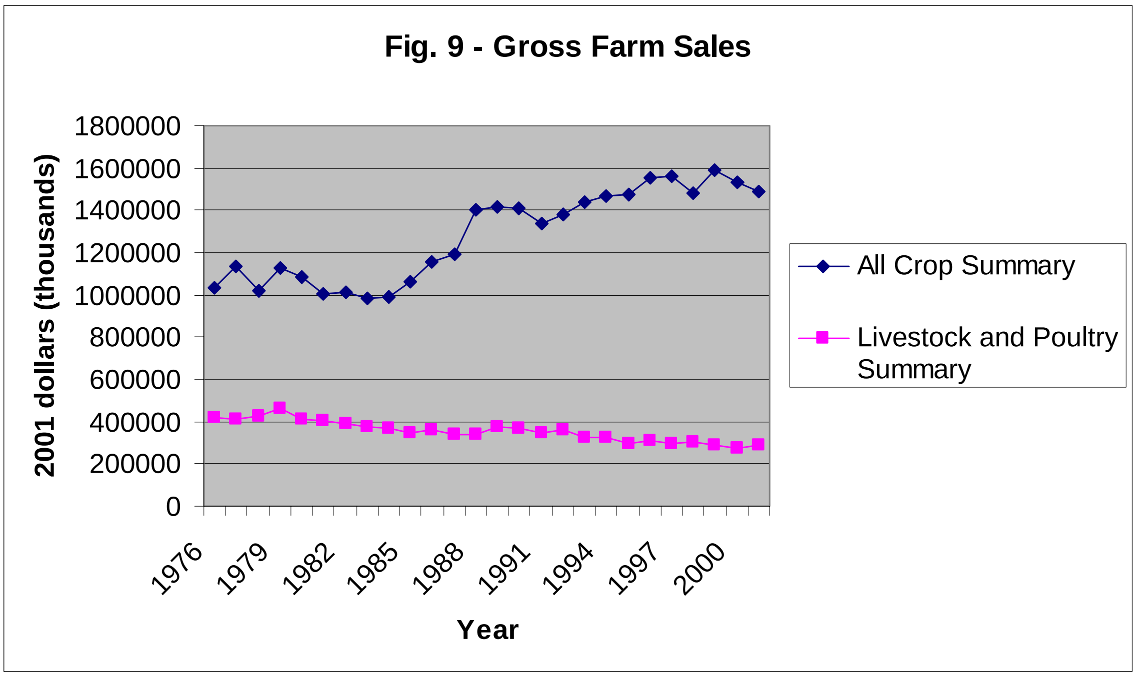


(Source: OAIN)

Clearly, the allocation of land to specific crops is by no means a static phenomenon in the Willamette Valley. The dynamics of Valley land allocation is indicative of the presence of flexible agricultural producers as well as a climate and soil base that is suitable to multiple crops.

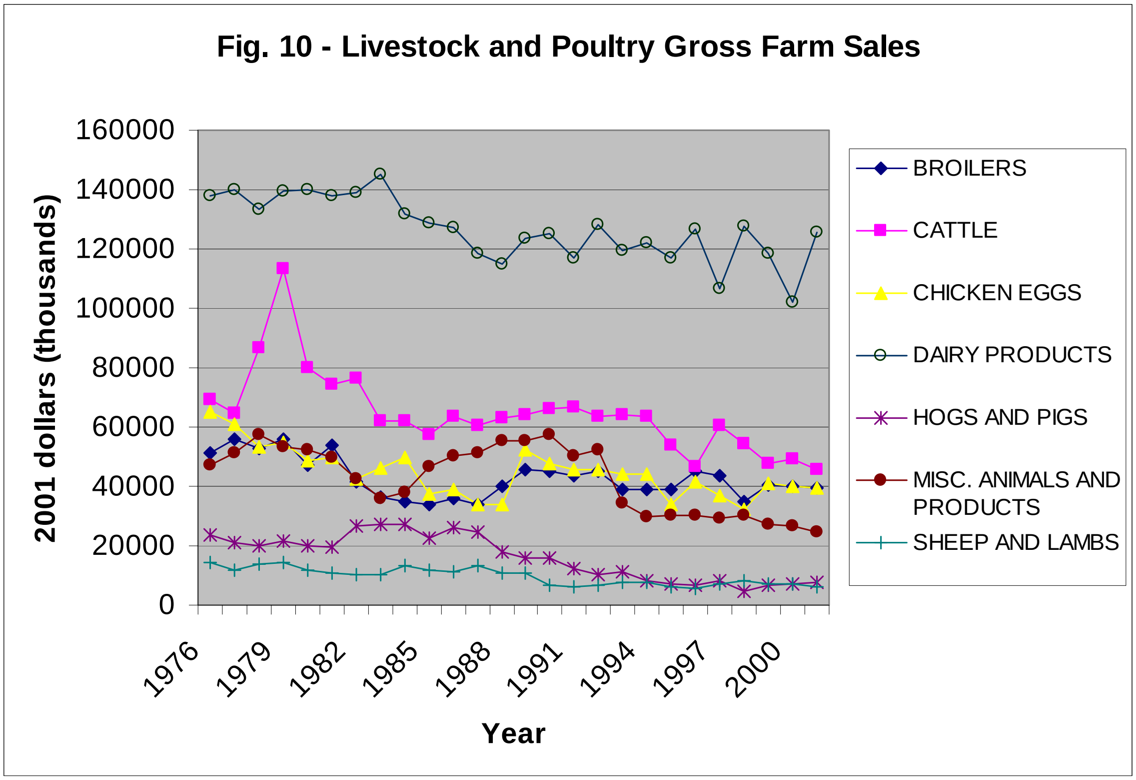
2.4 Gross Farm Sales Trends

In the Willamette Valley, crop sales increased in real terms by approximately 44% between 1976 and 2001 (Figure 9), highlighted by a massive 288% increase in gross sales of specialty products, which included nursery and greenhouse crops. Cattle and livestock related sales did not favor as well, losing approximately 31% in sales over this same time period.



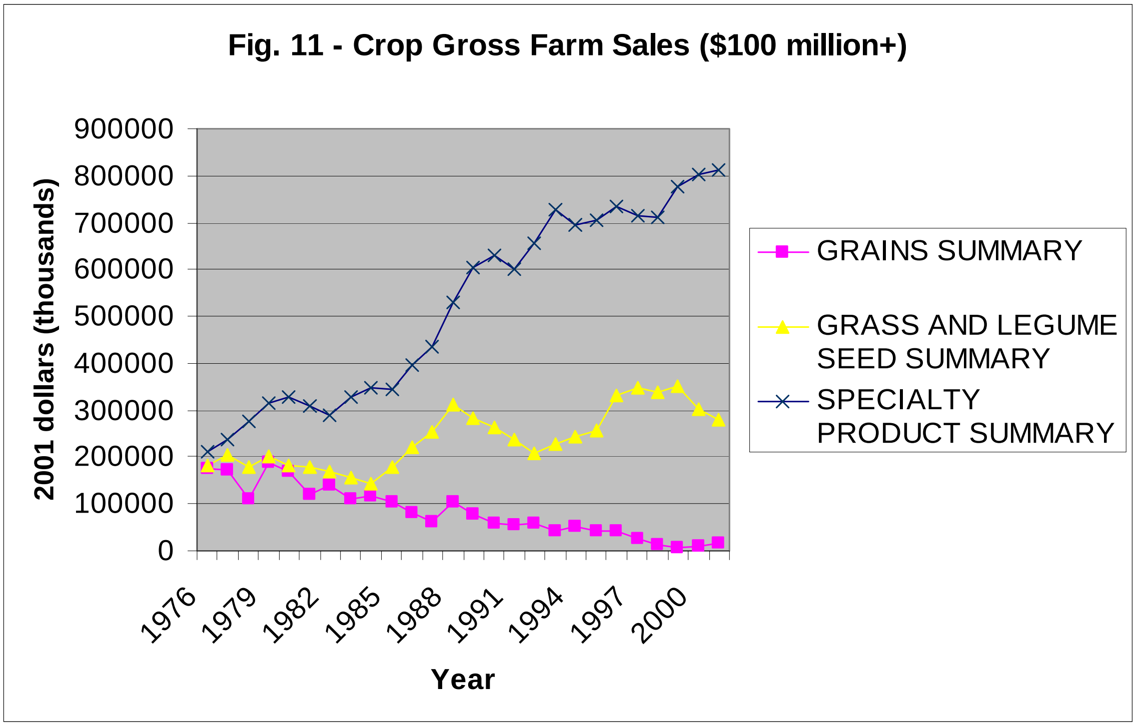
(Source: OAIN)

In breaking down the decrease in livestock and poultry related sales, the largest decline (in percentage terms) belongs to hogs and pigs, which lost 67% of their gross sales between 1976 and 2001. The swine industry was followed closely by the sheep and lambs industry, which lost 58% of gross sales in the same time period. In fact, every major category of livestock and poultry saw losses in gross sales; with chicken eggs losing 39%, cattle losing 34%, broilers losing 23% and dairy products losing 9% (Figure 10).



(Source: OAIN)

The increase in gross crop sales was completely dominated by the huge 288% increase in sales of specialty products between 1976 and 2001 (Figure 11). Other crops with an increase in gross sales over this same time period include vegetable and truck crops (28%), tree fruit and nuts (22%), hay and forage (70%), and grass and legume seeds (54%). Crops with a decrease in gross sales include field crops (-58%), grains (-90%), and small fruit and berries (-20%) (Figure 12). As expected, gross sales and acres devoted to a particular crop are closely correlated. The general trend in the Valley currently appears to be a shift in land use and sales away from livestock and poultry products and towards crop production, particularly grass and legume seeds (in terms of land) and specialty products (in terms of gross sales).



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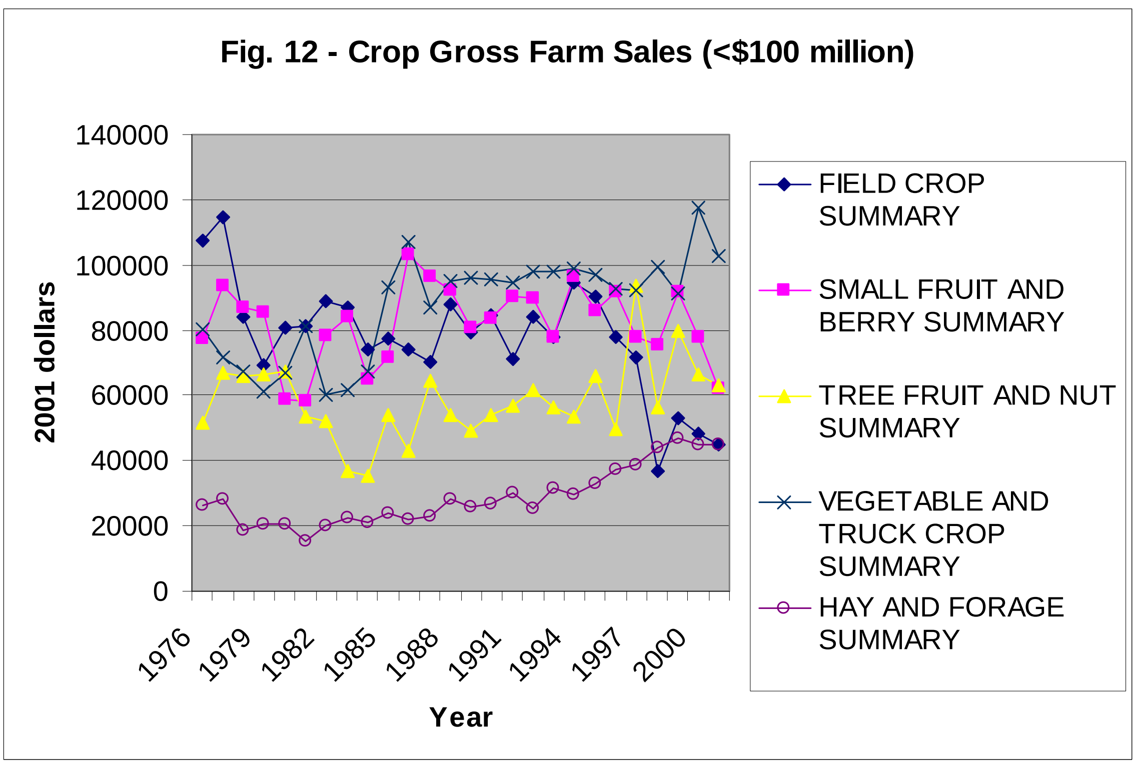
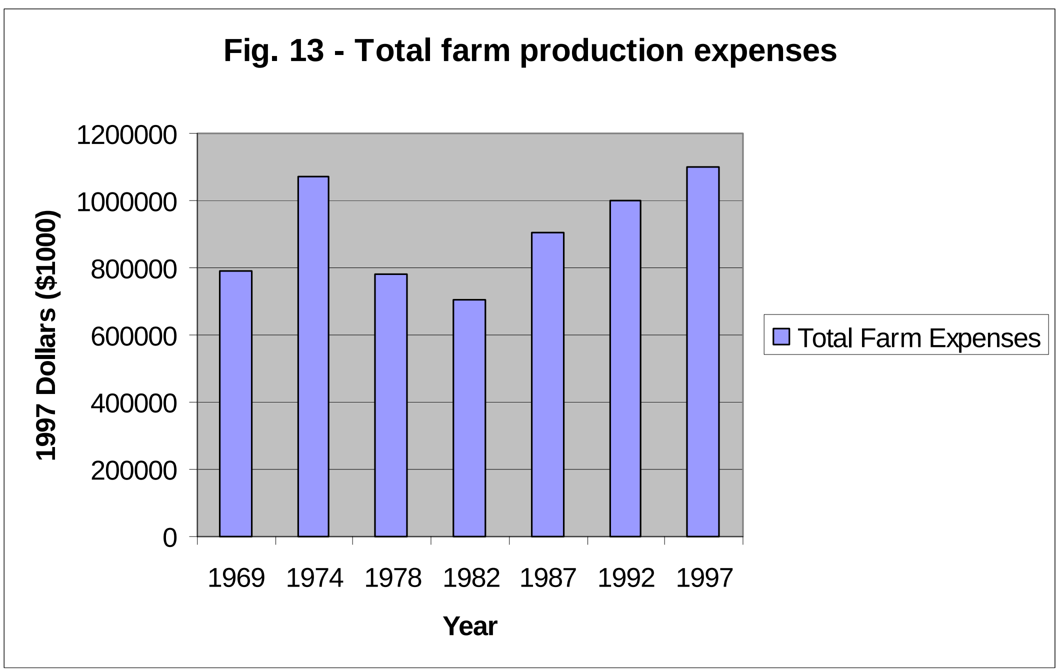


(Source: OAIN)

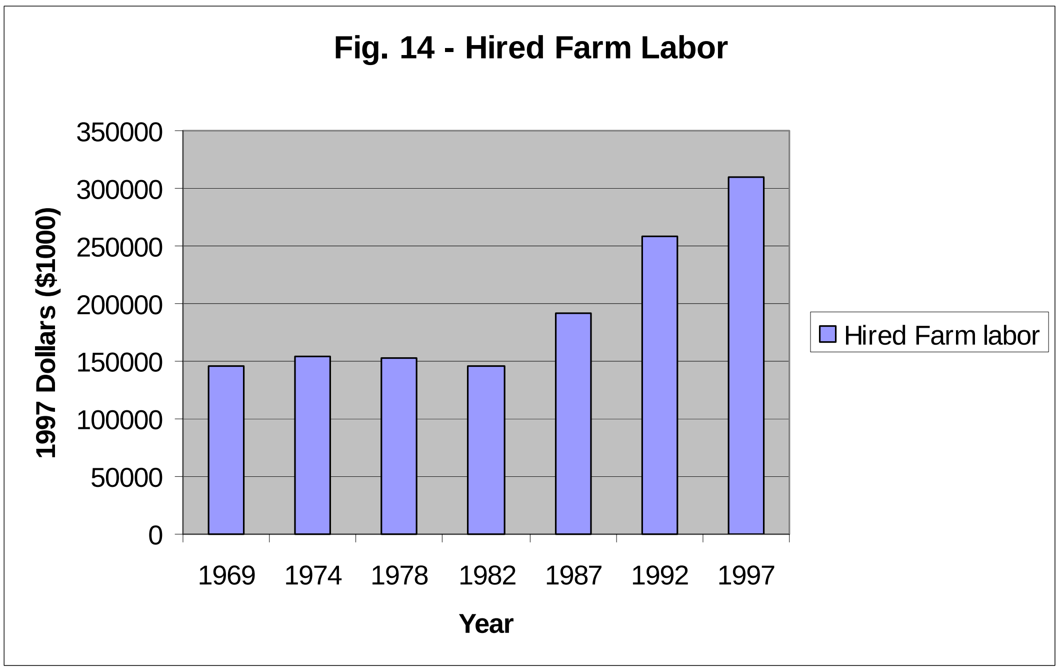
2.5 Farm Expenses

Total Valley expenditures on agricultural inputs increased by 40% (in 1997 dollars) between 1969 and 1997 (Figure 13). The largest increases included contract labor (159%), agricultural chemicals (146%), hired farm labor (112%), seeds, bulbs, plants and trees (81%), commercial fertilizer (15%), and petroleum products (12%). The primary decreases in aggregate expenditures were in the livestock and poultry sector, including livestock and poultry purchased (-33%), commercially mixed formula seeds for livestock and poultry (-18%), and feed for livestock and poultry (-9%). Adjustments in the products discussed above can be seen in Figures 14-17. Overall, these expenditure trends were expected, given the changes in production and land use discussed above. The shift in focus of Valley farmers from livestock and poultry towards crop production appears to be driving these changes in expenditures.

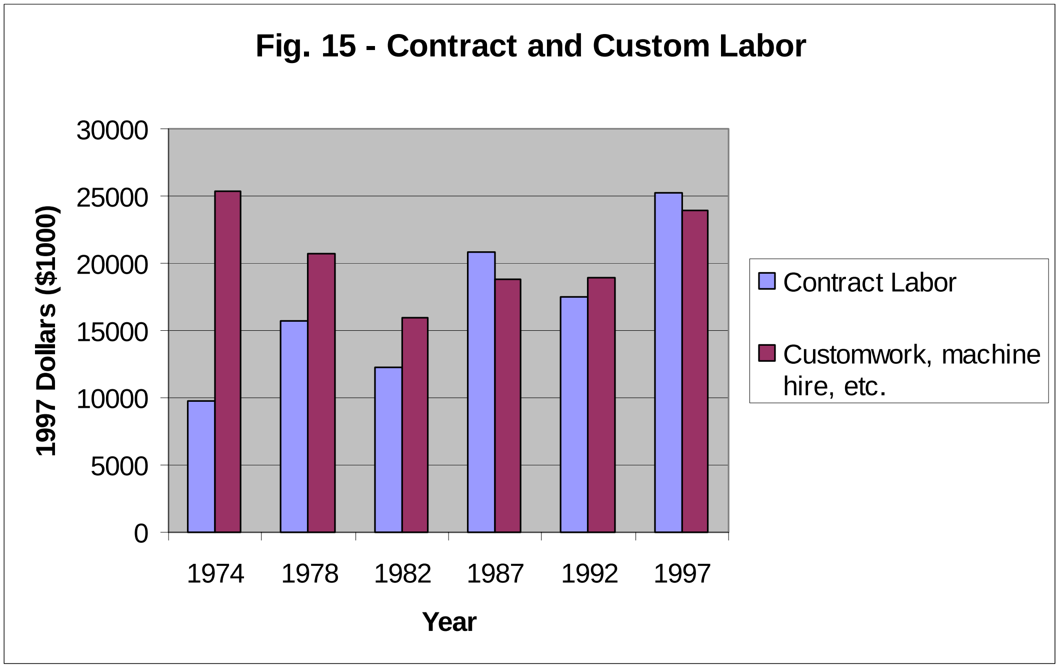


(Source: Census of Agriculture)

Of particular interest is the large increase in hired farm labor, with expenditures increasing by almost $164 million in real terms between 1969 and 1997 (Figure 13). Given the large increase in gross sales of high labor requiring specialty products like nursery and greenhouse crops, this increase in hired farm labor is not surprising. What is interesting is that specialty products do not use land as extensively as traditional field crops.



(Source: Census of Agriculture)



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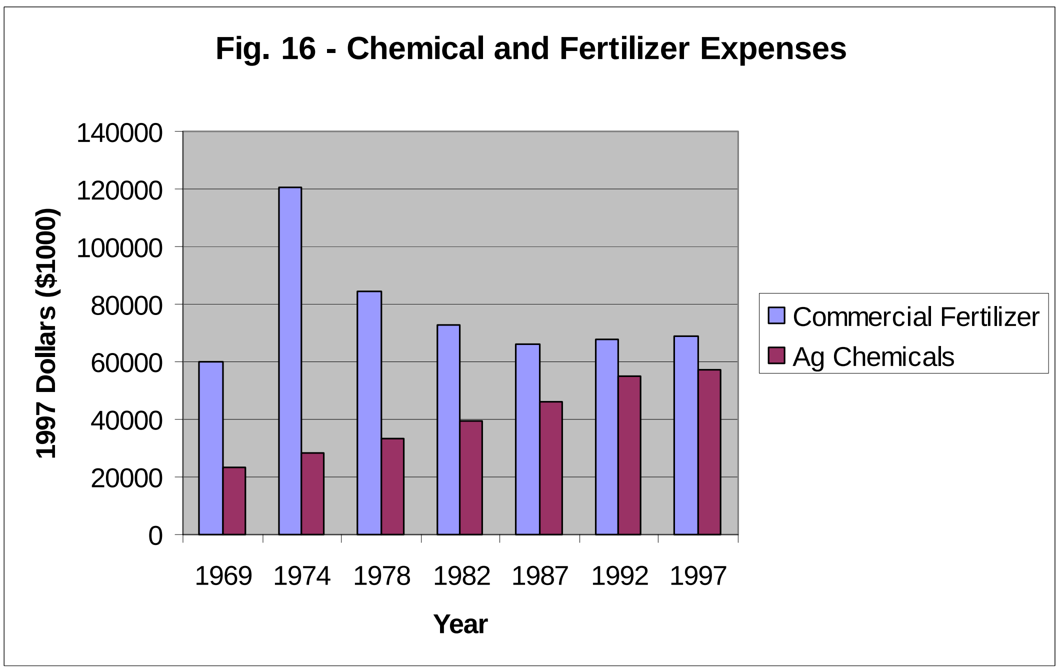

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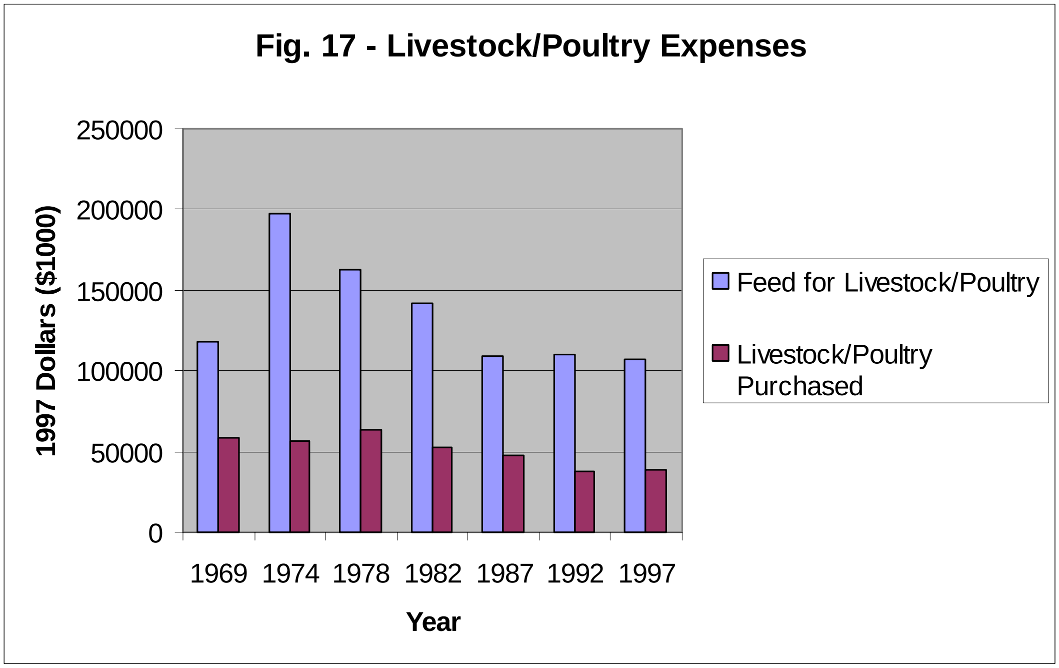
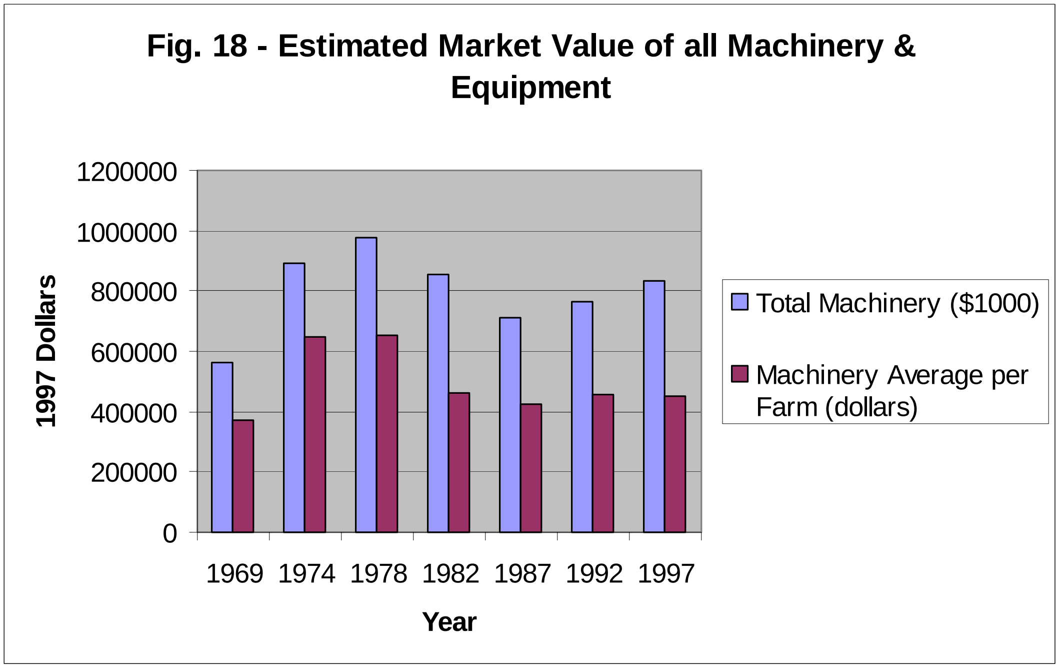


(Source: Census of Agriculture)

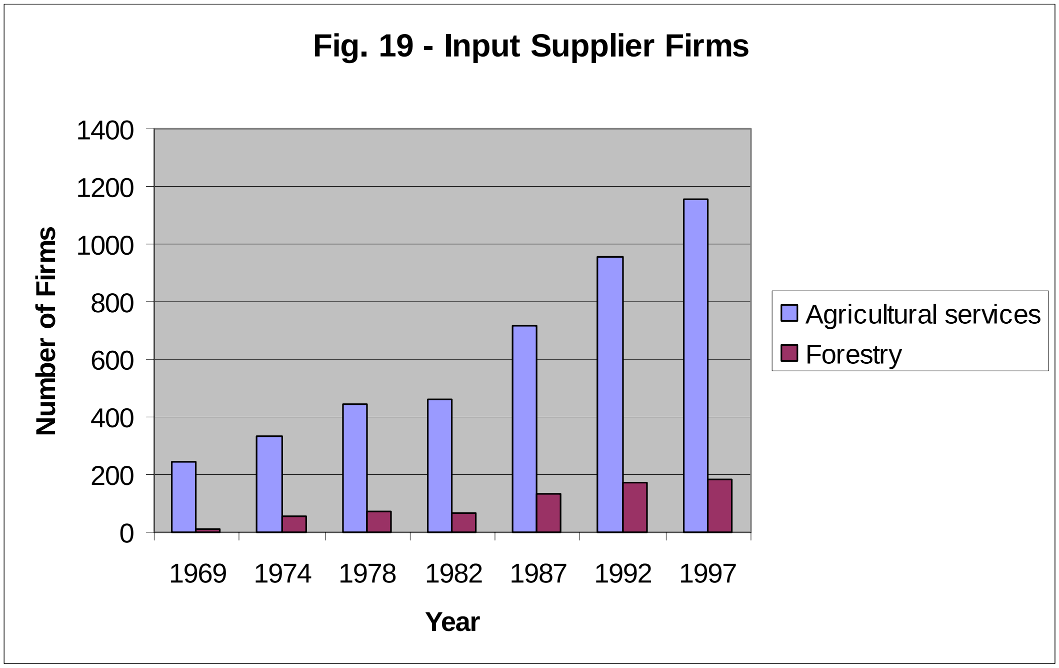
The importance of machinery for agricultural producers has fluctuated in recent years, with a 22% increase in the average market value of machinery per farm over the 1969 to 1997 time period (Figure 18). However, the 1997 value is down 15% (in real terms) from a high in 1978, when agricultural land values were also at their peak.



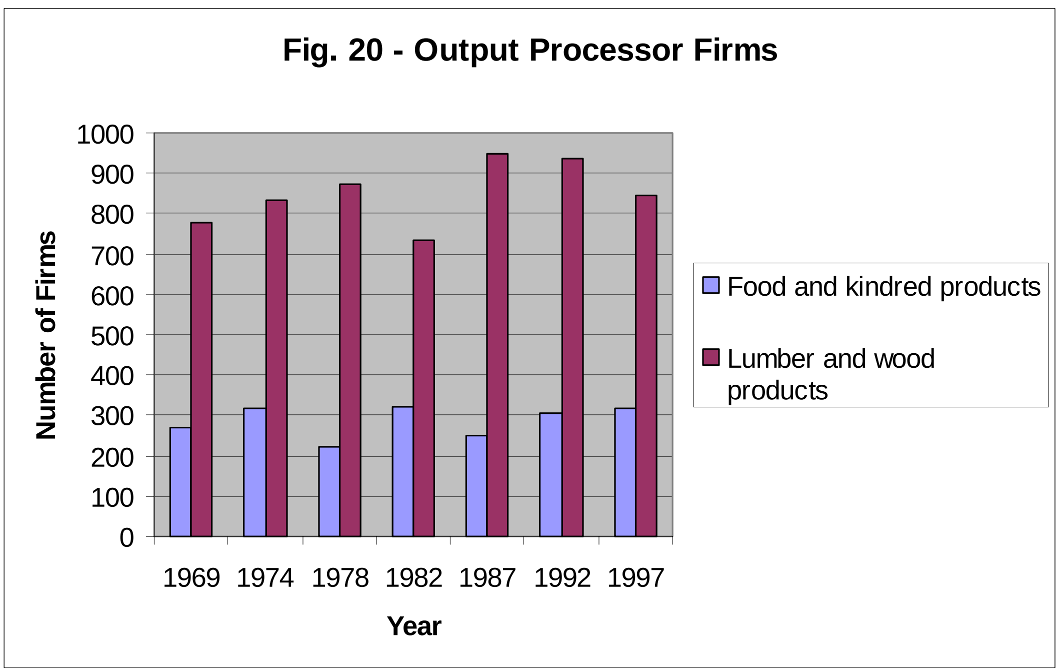
(Source: Census of Agriculture)

2.6 Farm and Agricultural Infrastructure Employment

The number of input supplier firms increased dramatically between 1969 and 1997 (Figure 15). The Valley gained 911 new firms in agricultural services (SIC 0700) and 173 in forestry (SIC 0800). Agricultural services consist of firms such as crop services, animal services, farm labor and management services. The number of processor firms also increased in this time period (Figure 16), with 48 new firms in food products (SIC 2000) and 68 new firms in lumber and wood products (SIC 2400). Food products firms consist of those firms producing products such as meat, dairy, vegetable, and related products. The gain in agricultural services firms must be placed in context, as the 368% increase is only slightly higher than the 320% increase in the non-Willamette Valley portion of Oregon, or the 295% increase in the U.S. as a whole. It appears that this gain mirrored what happened at broader levels.

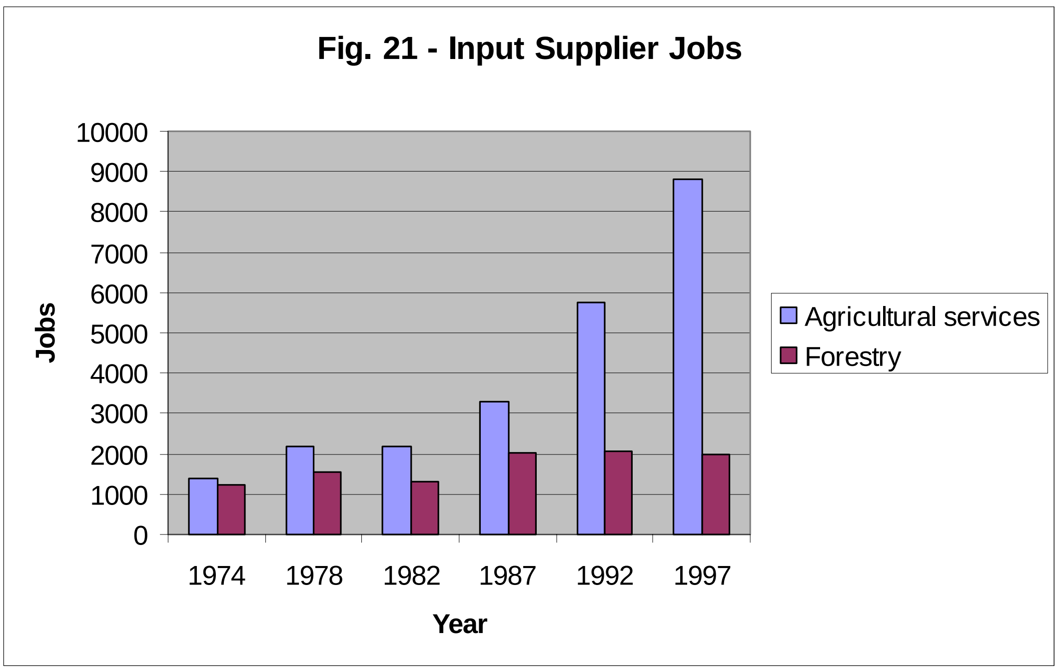


(Source: US Census Bureau)

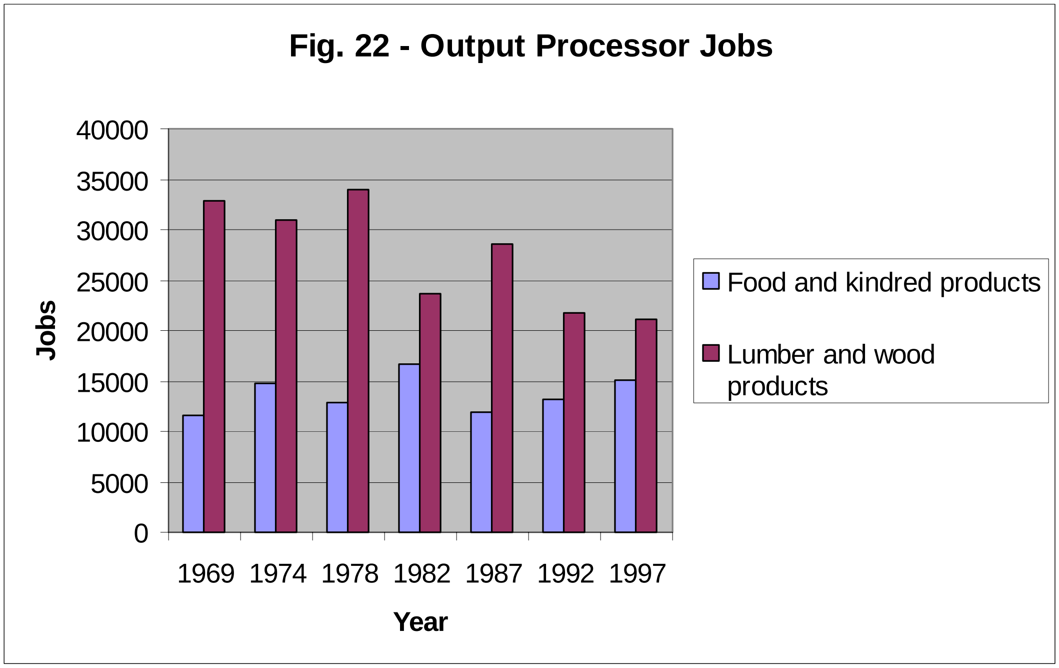


(Source: US Census Bureau)

In terms of employment, agricultural services had a huge increase of over 7,000 jobs (525%) between 1974 and 1997, and forestry saw an increase of almost 800 jobs (65%) (Figure 17). Again, this increase in agricultural service jobs must be placed in the context of a 332% and 314% increase in employment in this same sector for the non-Willamette Valley portion of Oregon and the U.S. as a whole. In output-processor jobs, employment in food products increased by over 3,500 (30%), while employment in lumber and wood products fell by 11,700 (-36%) (Figure 18). The shift to agricultural commodities that require more inputs on less land is likely driving the increase in agricultural processor employment.

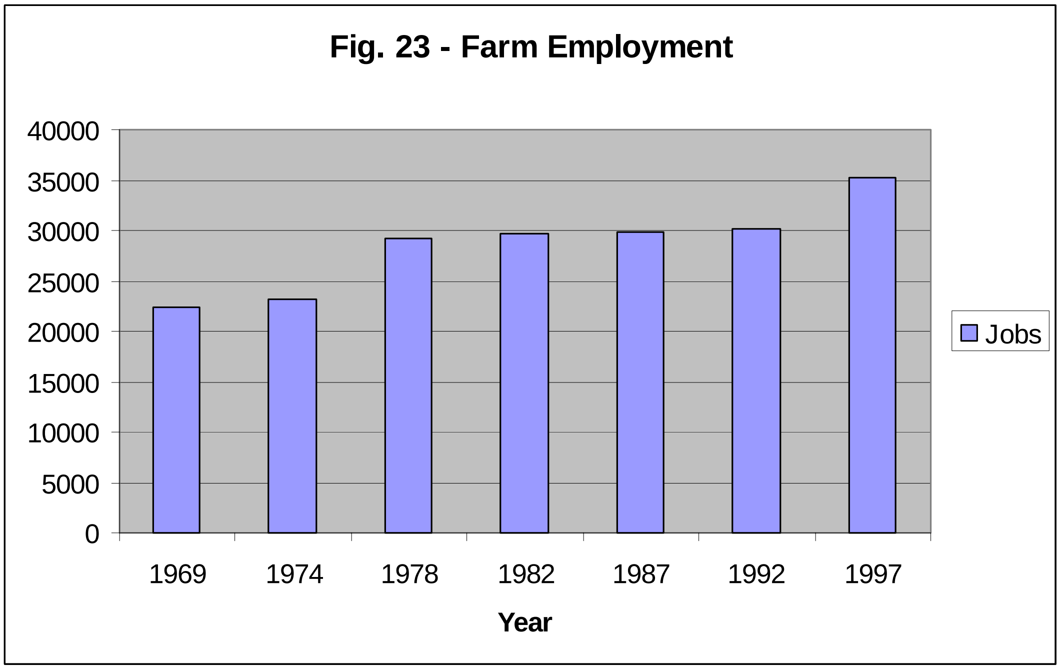


(Source: US Census Bureau)



(Source: US Census Bureau)

Farm employment experienced a 57% increase between 1969 and 1997 (Figure 23). This translates to a total of over 12,800 jobs and matches the increases noted above in number of farms and expenses on labor. This trend in farm employment is strikingly different from the non-Willamette Valley portion of Oregon and the U.S. as a whole. The non-Valley portion of Oregon saw only a 6% increase in farm employment between 1969 and 1997, while the U.S. as a whole saw a 22% decline in farm employment over the same time period. Clearly, farm employment in the Valley is growing at a much faster rate than elsewhere.



(Source: Bureau of Economic Analysis)

2.7 Land Use Laws

Any discussion of recent agricultural land use in the Willamette Valley would be incomplete without mentioning Oregon's famous land-use planning system. On May 29, 1973, Oregon Senate Bill 100 was passed, creating the most comprehensive statewide land use planning program in the country. It required every Oregon city and county to prepare a comprehensive plan that was consistent with a set of general statewide planning goals. Farmland preservation is a specific objective of Senate Bill 100, as expressed in Planning Goal 3: "Preserving Farmland"(Liberty, 1992).

Planning Goal 3 outlined statutes and administrative rules designed explicitly to preserve farmland. It established land to be protected by Exclusive Farm Use (EFU) zones. Land that meets the "agricultural land" definition was mandated to be zoned EFU and was therefore subject to property tax benefits and strict partitioning guidelines[3]. Exclusive Farm Use zones restrict land use to farming and its closely related activities. Oregon's statutes even recognize the potential for conflict when non-farm activities move into agricultural areas by authorizing counties to require residents of non-farm dwellings in these areas to sign statements waiving complaints about accepted farming practices (Liberty, 1992).

In addition to Goal 3, Senate Bill 100 also established an "urban containment" policy under Planning Goal 14 (Liberty, 1992). Goal 14 requires every city and incorporated community to establish an UGB, which is capable of accommodating growth during the planning period, generally 20 years. Urban growth boundaries place limits on urban development, with most development being restricted to within the UGB. Land outside the UGB is available for farm, forest, or other open space uses. In addition to UGBs and EFUs, rural exception areas were also designated on lands that were already committed to non-resource uses, such as rural residential, rural commercial, or rural industrial uses.

In an analysis of the effect of UGBs on farmland preservation, (Nelson, 1994) goes a step beyond price effects by claiming a link between UGB policies and farmland production. Nelson suggests that a relationship exists between UGBs and production because the separation of urban and agricultural uses helps reduce negative externalities (such as spraying, odors, and noise) from agricultural production on urban residents. This reduction in negative externalities helps reduce conflicts with urban residents, which in turn reduces the probability that urban residents will place additional constraints on

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[3] Agricultural land in western Oregon is defined under Goal 3 as land of predominantly Class I, II, III and IV soils and other lands that are suitable for farm use. Additionally, lands in other classes which are necessary to permit farm practices on adjacent lands are included as "agricultural land" (Liberty, 1992).

farmland production (Nelson, 1994). In effect, Nelson argues that the clustering of agricultural and urban uses achieved through Oregon's land use planning allows farmers more production options, and thus more opportunities for profit.

2.8 Substitution and Agricultural Infrastructure

The allocation of land to agriculture is a dynamic process in the Willamette Valley, driven by profitability of different uses, landowner preferences, and land use planning. The Valley's temperate climate and excellent soils give farmers many options in terms of what they produce. In contrast to the drier portions of eastern Oregon, where most land is only suitable for grazing or specific crops, the combination of climate and soils in the Valley gives farmers greater choice in terms of what they can produce. In addition to choice among crops, the Valley's growing population base also gives farmers options in terms of non-agricultural development. This development option adds another element to a farmer's decision process and another potential problem for those concerned with farmland preservation.

The addition of 55% more people to the Valley since 1997 combined with the loss of 11% of the Valley's farmland is prime evidence that the loss of farmland is a valid concern. However, the relationship between the amount of land in agriculture and the surrounding agricultural infrastructure is still not clear. The information on infrastructure provided from historical data is highly dependent on the commodity mix and the very different land and infrastructure requirements of various commodities. While total farmland has been reduced by 11% between 1969 and 1997, gross farm sales in the Valley have increased by 22.5% in real terms; farm expenses rose by almost 40% in real terms; farm employment increased by 57%. There are 911 new firms and 7,000 new jobs in agricultural services, and there are 48 new firms and 3,500 new jobs in food products production. In order to understand the dynamics between land in agriculture and the supporting industries, one needs to understand the substitution patterns farmers use to determine which crops to produce. Additionally, the substitution patterns that agricultural infrastructure firms use to support the constantly changing patterns of land usage.

Oregon's farmland protection program is designed to direct land use so that a maximum amount of agricultural land is preserved in large blocks in order to maintain the farm economy of the State. Implicit in this goal is the hypothesis that the spatial concentration of farmers is important. As Bruce Andrews and Richard Benner articulated, it ". . . [I]s not just a question of acres. It's a question of 'critical mass.' Nobody knows precisely how many acres of production are needed to sustain agricultural processors, implement dealers, farmers markets and other farm-related businesses in a region" [*The Oregonian*, August 13, 1998](Andrews & Benner, 1989).

Andrews and Benner hypothesized that the existence of a 'threshold', where a minimum amount of agricultural land is needed to support a farm economy. If a region loses enough agricultural land such that the threshold is reached, then the remaining farms may no longer be viable. Economically, the whole concept of a 'threshold' is driven by the point at which substitution is no longer possible. The threshold would be reached when support firms can no longer substitute one service for another, thereby leading to a loss in surrounding infrastructure. The cumulative loss in surrounding infrastructure then has the potential to make the remaining farms less viable if the farmers are unable to substitute to other products and remain economically viable.

The aggregate data presented earlier indicate several substitution patterns, including a strong movement in the Valley away from livestock and poultry products and towards crop production. Within crop production, the data also indicates a significant shift in land usage away from crops like grains and field crops and towards grass/legume seeds and tree fruit and nuts. In terms of sales, the explosion of revenue in specialty products like nursery and greenhouse crops suggests a reallocation of resources towards these products. In the case of labor-intensive crops like nursery and greenhouse products, this reallocation of resources can also be seen in the sizable increase of over 100% in expenses on hired farm labor between 1982 and 1997.

The case of substitution between grains and grass/legume seeds is a good example of the role of conversion costs. Since grains and grass seed production use similar inputs, the cost of converting from one crop to another will be low relative to the cost of converting to a different crop, such as tree fruits. Thus, a farmer converting from one land use to another will consider the relative profitability of all land uses (including development), as well as the cost of converting. Although specific transitions between crops are not observed in the data presented here, examination of Figure 7 is certainly suggestive of the possibility that grass seed production was the main substitute for a substantial portion of the decline in grain production over the last 25 years.

The recent transitions in Willamette Valley agriculture have clear implications for the surrounding agricultural infrastructure. The decline in livestock and poultry products and the increase in crop production suggest that the surrounding infrastructure has probably adjusted, or is in the process of adjusting, to this shift in farm production. Expense data adds evidence to this hypothesis, with expenses on all livestock/poultry related products declining while chemicals and labor expenses increased significantly. Unfortunately, the aggregate firm and employment data on agricultural infrastructure does not give enough detail to determine specific shifts within agricultural service or food product manufacturing industries. Future collection of this data would yield obvious benefits in quantifying the substitution patterns used by the surrounding infrastructure.

The most important factor for agricultural infrastructure is the demand by farms for land, products and services. With the shift toward high input, low land requiring commodities, this demand may or may not be correlated with the amount of aggregate land in farming. The existence of high input, low land requiring products like nursery and greenhouse crops suggests that for such crops there may not be a strong correlation between aggregate land in farming and surrounding infrastructure. However, this does not rule out the possibility that a relationship between land in farms and infrastructure exists for certain crops. For example, it is possible that production of certain crops that require specialized output processing require there to be a strong concentration of similar farms and infrastructure in the area.

In particular, examination of the large declines in land devoted to grain production brings about the possibility that a threshold of grain-producing land was reached at some point, which precipitated additional land going out of grain production. However, the flexibility of Willamette Valley soils to produce many different types of crops implies that substitution is usually an option and thus, loss of land devoted to one crop may correspond with an increase in land devoted to another crop. This possibility is evident in Figure 7, where the loss of land in grains is mirrored closely by a gain in land devoted to grass and legume seed production. Nevertheless, if one is looking for the possibility of a critical mass or threshold in agriculture, grain production is the most likely candidate for the Willamette Valley over the last 25 years.

2.9 Historical Review Summary

The historical review of agricultural in the Willamette Valley highlights many unique aspects of the region. Soil quality and climate as well as proactive land use planning creates a dynamic agricultural region. These qualities also present difficult challenges for modeling the agricultural economy. Producers' ability to substitute between commodities, their dependence on local and regional infrastructure, and the role of institutional structure should be considered in the modeling process.

The review has revealed the continuing transformation of agriculture in the region. Farm numbers are increasing while farm size is decreasing. Producers show a great degree of adaptability, producing multiple products and changing commodities often. Additionally, there appears to be a general shift towards commodities that require less land while relying more heavily on inputs. Finally, land use laws appear to play a key role in dictating the degree and direction of farmland loss. All of these trends will provide guidance for the modeling process in Section 4.

The historical review has called attention to some specific challenges for the modeling process. In particular, the quality and availability of data may be problematic for the modeling process. Currently available data is usually aggregated to high levels -- such as the county level -- and time series are often incomplete or inconsistent. Also, data on individual decisions, such as the decision to leave agriculture, are non-existent. The model presented in Section 4 attempts to alleviate some of these data issues by developing a model that exploits readily accessible public data.

3. Interrelationships Among Neighboring Farms in a Regional Economy

Population growth has caused urban areas to encroach upon traditionally rural agricultural communities. This encroachment has caused the rural landscape to change both nationally and in Oregon. Historically rural agricultural areas are now often home to housing developments, large single-family homes and improved roads. Despite the changing landscape, rural America is still considered the home of the values that built this nation – self-reliance, concern for neighbors and community, and honesty (Garkovich, Bokemeier, & Foote, 1995). However, as the landscape changes and agricultural production takes new form, these values may be threatened.

Interactions between neighbors and community involvement in rural America grew from a dependence on close-knit communities in order to survive. Changes in production practices have altered the relationship of neighboring farms, and the fragmentation of rural landscapes threatens the community bond that has always been characteristic of rural America. As the interactions between neighboring farmers becomes less prevalent, the remaining producers may find it even more challenging to remain in production. They lose the ability to share equipment, combine harvest responsibilities, rent land and have fewer support resources in times of need. As rural regions become more fragmented from urban development, farmers face new challenges not known to their predecessors. Non-farm residences may not tolerate common or future practices necessary for efficient production, such as chemical use and controlled burning.

Polk County, in Oregon's fertile Willamette Valley, is a prime example of such growth and change. Since 1960, it has experienced a dramatic population growth, expanding its population 87% compared to 60% in Oregon and only 38% nationwide (Census, 1997). From 1980 to 1990, employment in agriculture, forestry and fishing increased 12%, while employment in the more urban industries, wholesale and resale trade, and services increased 34% (Census, 1997).

In order to determine the importance of interrelationships in a rural economy, an agricultural producer survey was administered to 30 farmers in Polk County. The survey consisted of 73 questions covering general farm characteristics, neighbor interactions and financial information. The respondents were identified by the Oregon Farm Bureau. The sample is not random so one must be careful in attempting to generalize the results to larger populations.

The Polk County sample highlights the diversity of agriculture in Oregon's Willamette Valley[4]. Farms in the sample varied in size from a six-acre vineyard to a 1,660-acre grass seed operation. The average farm size was 514 acres compared to the 1997 Census overall average of 149 acres and a 369 acre average for farms with sales greater than $10,000. On average, the farms sampled listed at least three primary products with only two respondents listing a single primary product. The top three products (by OAIN category) were grass and legume seed, grains, and livestock and poultry, respectively. As seen in the historical review, the crop diversity is typical of Willamette Valley agriculture. The Valley's unique climate and soils have made it possible for producers to adapt in response to changing economic conditions.

Survey responses suggest that strong neighbor interactions occur in Polk County. Interactions can be divided into two categories: 1) interactions between farms; and 2) interactions with non-farming neighbors.

3.1 Interaction Between Farms

The survey suggests that strong personal and financial relationships exist between farmers in Polk County. Ninety percent of survey respondents described their relationship with neighboring farmers as "friends," suggesting that significant interaction occurs. All respondents share advice with neighboring farms and 28 of 30 believe that they have financially benefited from such sharing. Within the sample it is common to rent land from or to neighboring farmers in addition to land trading (See Figure 24).

In the survey, 77% of the farmers reported renting land, with an average of 253 acres rented. The abundance of land renting within the sample suggests that production may extend well beyond individual property lines and therefore changes in neighbor relationships could jeopardize production for many farmers. The survey also suggests that changes in the pool of rent-able land are already occurring, with 20% of respondents

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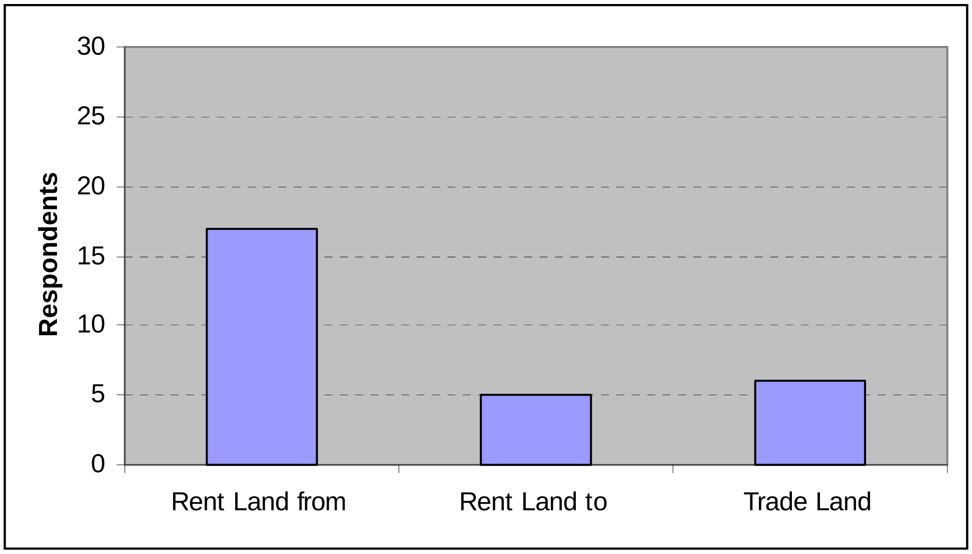
[4] For a complete review of the sample responses and a copy of the Agricultural Producer Survey see Appendix A.1

reporting losing rental land in the past five years. Additionally, 73% of the producers in the survey do not farm on one contiguous piece of land and 20% operate on land over seven miles from their home base. With production occurring over a large area changes in land use may affect production several miles away.

Fig. 24
Land Use among Neighboring Farmers in Polk County



(Source: Agricultural Producer Survey)

Regional farmers also participate in several additional economic transactions with neighboring farmers. Nearly 30% of respondents buy or sell goods to other farmers and perform or receive custom work on a regular basis, while 40% share equipment (see Table 2).

Table 2
Economic Transactions Between Farms

	Sometimes	%	Usually	%
Buy Goods from Other Farms (Such as but not limited to seeds, nursery stock, hay, silage, grain, animal waste, mulch, compost, livestock, posts, etc.)	*7*	*23%*	*10*	*33%*
Sell Goods to Other Farms	*11*	*37%*	*9*	*30%*
Perform Custom Work for Other Operators (Such as but not limited to field preparation, fertilizing, spraying cultivation, mowing, bailing, swathing, combining, crop drying, mint distilling, insect and plant disease scouting, bulldozing, ditch digging, tiling, seed cleaning, trucking, equipment repair and manufacture, etc.)	*8*	*27%*	*11*	*37%*
Receive Custom Work from Other Operators	*10*	*33%*	*9*	*30%*
Share Equipment (Such as but not limited to rented, borrowed, and jointly owned equipment; including irrigation equipment, tractors, trucks, combines, bulldozers, harvesters, animal squeeze, portable fencing, scales, moisture testers, shop tools, etc.)	*8*	*27%*	*12*	*40%*
Joint Harvest with Other Operators	*5*	*17%*	*4*	*13%*

(Source: Agricultural Producer Survey)

These types of interactions are not restricted to "next door neighbors." Most respondents buy goods from farmers within five miles; however, 10-to-20 mile distances were common and not restricted by county lines. Farmers reported buying goods from Marion, Yamhill, and Klamath Counties and two respondents routinely buy goods from northeastern Oregon farmers. While most products are sold within the Willamette Valley, one farmer reported nation wide sales. This is likely a result of local processing plants receiving the majority of the region's agricultural production. Custom work and the sharing of equipment appear to be relatively local transactions. Almost all respondents perform or receive custom work within a ten-mile radius. Additionally, the majority of respondents that share equipment do so within five miles of their base of operations.

The geographic scope of farmer interactions provides significant insight into the agricultural infrastructure. Significant transactions occur with farmers "next door" to several counties away and throughout the State. This suggests that as agricultural communities shrink, the repercussions may be more widespread than previously thought.

Depending on the financial significance of neighbor interactions, Polk County farmers may be adversely effected by the loss of neighboring farms as well as farms several Counties away.

Although most interactions are difficult to economically quantify, many have potentially significant effects. Performing custom work can constitute a significant portion of income. More than 20% of the surveyed farmers reported some form of custom work as one of their primary products. Equipment sharing reduces costs and can increase efficiency. Additionally, large capital investments can potentially limit producers to specific commodities, while the ability to share equipment provides the ability to change commodities as markets fluctuate. Of the respondents who have shared equipment with neighbors, most reported cost savings. Over the past ten years one respondent believes to have saved approximately $300,000, while the average estimated saving is approximately $30,000. Loss of regional producers impedes such coordination and potentially increases the capital requirements of the farmers that remain in the region.

3.2 Interactions with Non-farming Neighbors

As improved roads and rural residences have moved into the farming countryside, new issues have arisen for Polk County farmers. The new rural residents often have little interest or knowledge of agricultural production. Their dream of country living does not include views blurred by tractor dust, and air filled with the odor of livestock or chemicals. As a result, farmers face rising costs and decreased efficiency due to these new conflicts.

Polk County's rapid population growth and the increase in alternative land uses allowed in EFU zones mean that many farmers operate relatively close to urban areas. The average distance from base of operation to urban growth boundary for survey respondents was a mere five miles, with the closest being 300 yards and the most distant 17 miles. All farms in the survey are well within commuting distance to nearby urban centers, thereby raising the likelihood of interactions with non-farming neighbors.

Despite the state's strict land use policies, many of the farms surveyed reported interactions with non-farming neighbors. Interactions range from having to change farming practices to court room litigation. A significant number of farms surveyed, 43%, reported having changed their farming practices due to non-farming neighbors. In most cases, these changes increased costs and/or decreased efficiency. Farms were forced to use more expensive and sometimes less effective chemicals to avoid lawsuits. Some decided to leave portions of their land fallow for fear of chemical drifts onto nearby residences; one farmer even reported renting out land instead of dealing with the issues raised by non-farming neighbors. Additionally, several farmers reported having to cease burning operations, thereby foregoing significant efficiency gains.

In addition to non-farming neighbor interactions leading farmers to change their production practices, they also take actions that have more direct effects. Of the farms surveyed, 37% reported being adversely affected by the actions of non-farming neighbors. Many respondents point out the litigious nature of their non-farming neighbors and have lost time and money due to lawsuits and courtroom appearances. Non-farm neighbors' recreational animals damage crops and livestock raising farmers' costs. In general, respondents indicated general weariness of their non-farming neighbors whom they see as argumentative and quick to complain to higher authorities.

In addition to raising costs and decreasing efficiency, altercations with a growing number of non-farming rural residents can potentially have non-pecuniary affects. Many farmers choose to stay in production or carrying on the family business for reasons beyond money. These "quality of life" aspects of rural living can serve to offset the financial challenges of agricultural production. Altercations with neighbors and lawyer visits are decreasing the quality of life for many farmers. One survey respondent remarked, "People (non-farming neighbors) who are litigious in nature serve to make farmers' lives miserable." As quality of life erodes, the opportunity cost to leaving agricultural decreases, increasing further the probability that farmers or their successors will choose to exit agriculture.

4. Modeling Farmland Conversion

The historical review and agricultural producer survey have highlighted the many unique aspects of agriculture in the Willamette Valley and Polk County. The area's fertile climate and soils, strict land use laws and growing population have combined to form a very complicated and interrelated agricultural economy. Modeling such an economy is an immense task. The Dynamic Simulation Model (DSM) was chosen for its ability to provide an understanding of complicated dynamic systems with multiple interrelationships. This modeling framework allows users to isolate key components of interest, for instance, neighbor interaction effects.

4.1 Conceptual Model of Land Conversion in Polk County, Oregon

Land in Polk County is divided into three categories: 1) forested land; 2) developed land; and 3) agricultural land. Forested land is assumed fixed over the near future and is therefore not subject to any land use decision. Developed land includes all land not specified as agricultural or forest land and therefore includes residential land, commercial land, industrial land and roadways. Development is assumed irreversible such that developed land can never be converted into farmland. Agricultural land is divided further into two categories: 1) restricted agricultural land (RAG); and 2) developable agricultural land (DAG). Restricted Agricultural Land incorporates all agricultural land operating outside UGB, while DAG includes all agricultural land operating within UGBs.

Within such a land categorization, the relevant land use decisions related to farmland conversion are those made by landowners holding DAG lands. These landowners can choose to continue agricultural production or permanently release their land for development purposes. If they continue agricultural production they receive a return on their land investment equal to:

$$AgROI = \frac{\pi_{Ag}}{\beta},$$

where π_{Ag} is the annual profits from agricultural use, and β is the market value of agricultural land. If they choose to release their land for development purposes they receive a payment for their land, which they can then put into an alternative investment. Thus, in every time period, landowners choose how much land to release by comparing the *AgROI* to the return on an alternative investment.

The alternative return is assumed to be the constant risk free rate of four percent. Therefore, agricultural returns and their determinants are the primary variables of interest in the model. *AgROI* is determined by the profits to agriculture and the market value of agricultural land. In this preliminary model, the market value is assumed constant, while the level of agricultural sales and expenses determine profits. In order to simplify the model and isolate the endogenous variables of interest, sales are assumed to follow their historical growth trend. Therefore, the primary variables determining conversion from agriculture to development uses are agricultural expenses and its determinants.

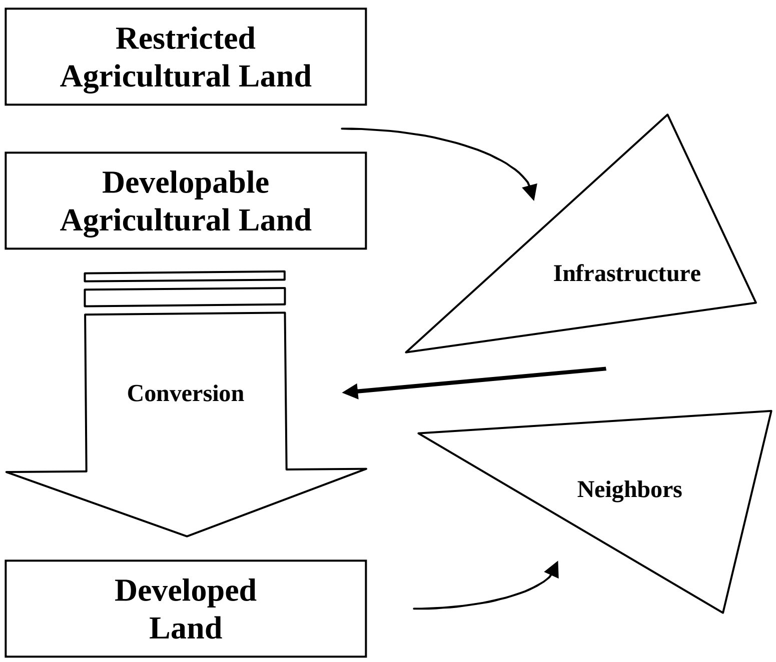
Agricultural expenses are specified to follow a constant historical growth rate with three interaction shift parameters: 1) neighbor interaction factor; 2) output processor factor; and 3) input supplier factor. As suggested by the agriculturist survey, interactions among neighboring farms can play a key role in the success of agricultural production. The neighbor interaction factor is meant to capture this affect and is specified as a constant dollar amount per acre-converted times the total number of acres converted to development. As acres are converted to development, the remaining agriculturalist will face higher expenses (Figure 25).

Fig. 25
Effect of Neighbor Interaction on Expenses

Additionally, the amount of agricultural infrastructure (output processors and input suppliers) can potentially affect agricultural production expenses by affecting access to production services. The numbers of processors and suppliers are assumed to be a function of the amount of land in agricultural production. So as land is converted to development, fewer suppliers and operators will remain to provide services and therefore expenses may rise. The crop mix and thus degree of dependence on services will determine size of the infrastructure effect.

The neighbor interaction effect and infrastructure effects outline the feedback effects that drive the simulation model. If the *AgROI* is low, leading some agriculturists to release their land for development purposes. The remaining agriculturists will face higher expenses and thus lower profits, increasing the probability that they also will cease agricultural production. The conceptual agricultural land conversion framework is shown in Figure 26.

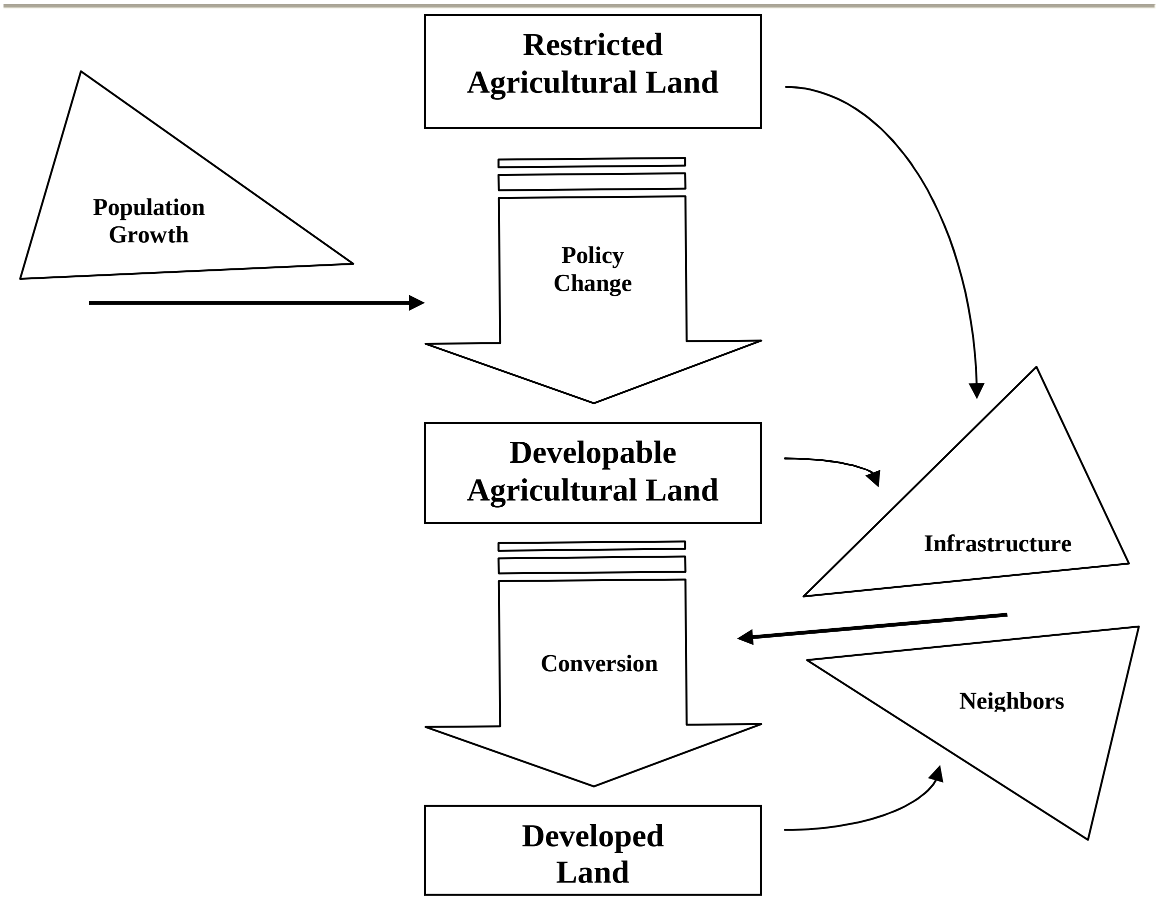
Fig. 26
Conceptual Determinants of Land Conversion



As outlined above, the conversion from an agricultural use to development can only occur on agricultural land inside an UGB. As such, conversion would be choked off quickly as agricultural land available for development was converted. Here, the distinction between restricted agricultural land and developable agricultural land becomes critical.

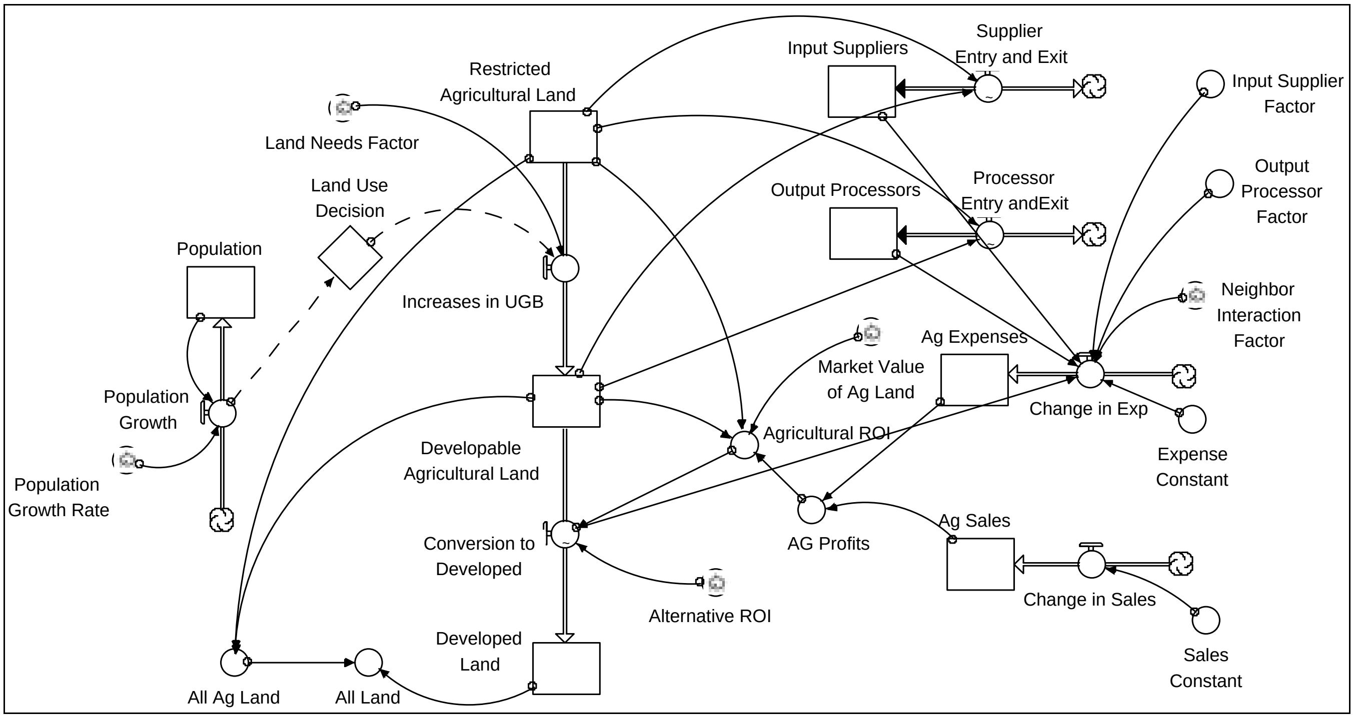
Restricted agricultural land is protected from development pressures as long as it is outside the UGB. Oregon land use policy allows adjustments in the UGB to adjust the quantity of developable agricultural land. Oregon's land use laws require the UGB to contain enough developable land to accommodate 20 years of population growth. With exponential population growth and a constant proportion of acres needed per new person, adjustments in land use policy allow land to be transferred from restricted to developable by expanding the UGB. By combining land use policy changes with the conversion of developable agricultural land, the conceptual land conversion model is complete (Figure 27)

Fig. 27
Conceptual Land Conversion Model



Using the conceptual model outlined above, land conversion is simulated using the STELLA 7.0.3 software package (Figure 28). Functional relationships were specified using historical data and results from the agricultural producer survey. The functional specification is provided in its entirety in Appendix A.2.

Fig. 28
Dynamic Simulation Model



4.2 Simulation of Land Conversion: Polk County Pilot Project

The dynamic simulation model uses the conceptual model outlined in section 4.1 and the functional specification in Appendix A.2 to simulate land conversion in Polk County, Oregon. Data was collected from various public forums including the Census Bureau, Bureau of Economic Analysis (BEA) and Oregon Department of Land Conservation and Development (DLCD). Given the current data quality and availability, the pilot simulation represents a valuable first step towards a descriptive model of land conversion. Although data limitations may not allow the model to accurately predict precise quantities of land, the current simulation allows users to explore the potential uses of a DSM, which simulates land conversion.

The following sub-sections, 4.2.1 and 4.2.2, depict the simulation with the currently available data on Polk County, Oregon. Section 4.2.1 provides a baseline simulation using underlying assumptions and current data. Section 4.2.2 depicts how the DSM can be used to consider the effects of alternate assumptions or land use policies on the rate of farmland conversion.

4.2.1 Baseline Simulation

Polk County zoning data is used to determine the starting values for the three land categories. Relying on insight from Jim Allen, Polk County Planning Director, the amount of developable agricultural land is assumed to be ten percent of the land within UGBs. The resulting starting values for land and appropriate zoning categories are given in Table 3.

Table 3
Starting Values for Land Categories

Category	Acres	Zoning Categories
Developed	29,295	Rural Residential Rural Industrial Rural Commercial Rural Service Center Other Rural 90% of Urban (UGB)
Developable	1,440	10% of Urban (UGB)
Restricted	185,000	Exclusive Farm Use

The starting values for the remaining categories and their data sources are given in Table 4.

Table 4
Initial Model Values

Variable	Initial Value	Year	Data Source	Notes
Population	45,231	1985	BEA	
Ag Expenses	$87,751	1985	BEA	$1999
Ag Sales	$101,417	1985	BEA	$1999
Input Suppliers	584	1985	Census	Regional[5]
Output Processors	242	1985	Census	Regional

With initial values determined, it remains to specify the constants in the model (Table 5).

Table 5
Model Constants

Parameter	Value	Units
Population Growth Rate	0.022	% / year
Land Needs Factor	0.300	acre / person
Alternative ROI	0.040	% return / year
Market Value of Ag Land	3.00	$1,000
Input Supplier Factor	0.00	$1,000 / firm
Output Processor Factor	0.00	$1,000 / firm
Neighbor Interaction Factor	0.015	$1,000 / acre
Expense Constant	1,188.60	$1,000 / year
Sales Constant	1,132.90	$1,000 / year

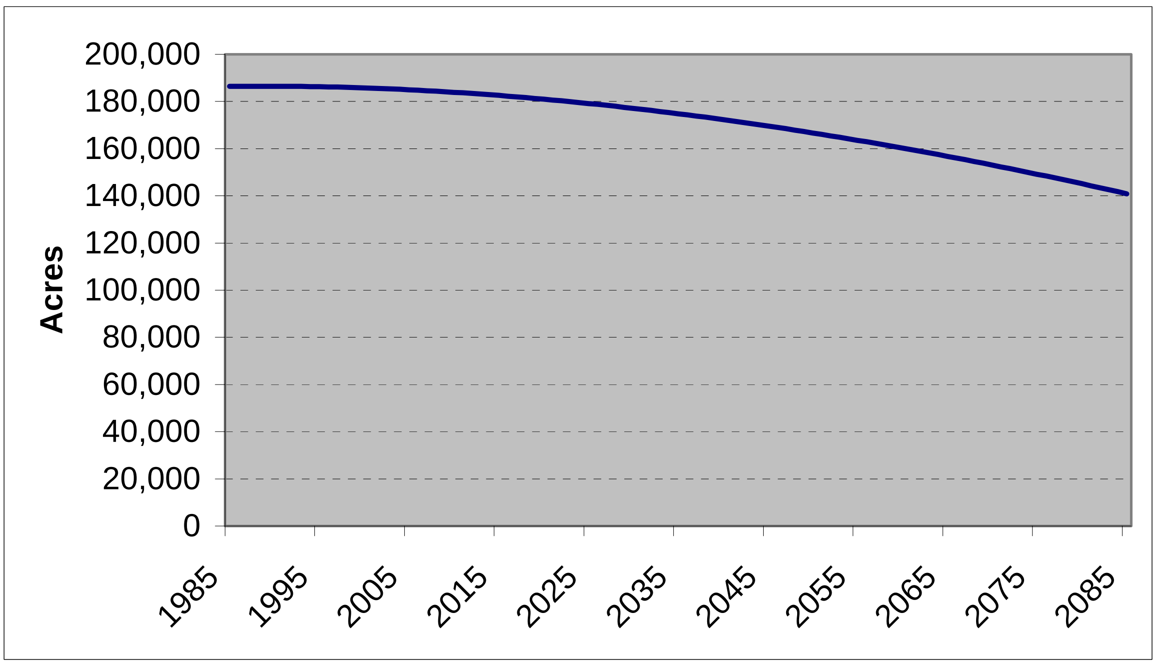
[5] The relevant number of input suppliers and output processors is measured at the regional level. The appropriate region is defined as the Willamette Valley (see footnote 1).

Table 5 highlights the fundamental baseline assumption of the simulation model.

Altering any of these assumptions will change the rate at which farmland is converted between categories. The affect of policy changes on these assumptions will be simulated in Section 4.2.2.

Baseline assumptions are used to simulate land conversion for 100 years beginning in 1985. The model depicts all agricultural land being lost at a slowly increasing rate (Figure 29)[6].

Fig. 29
Simulating the Loss of Agricultural Land

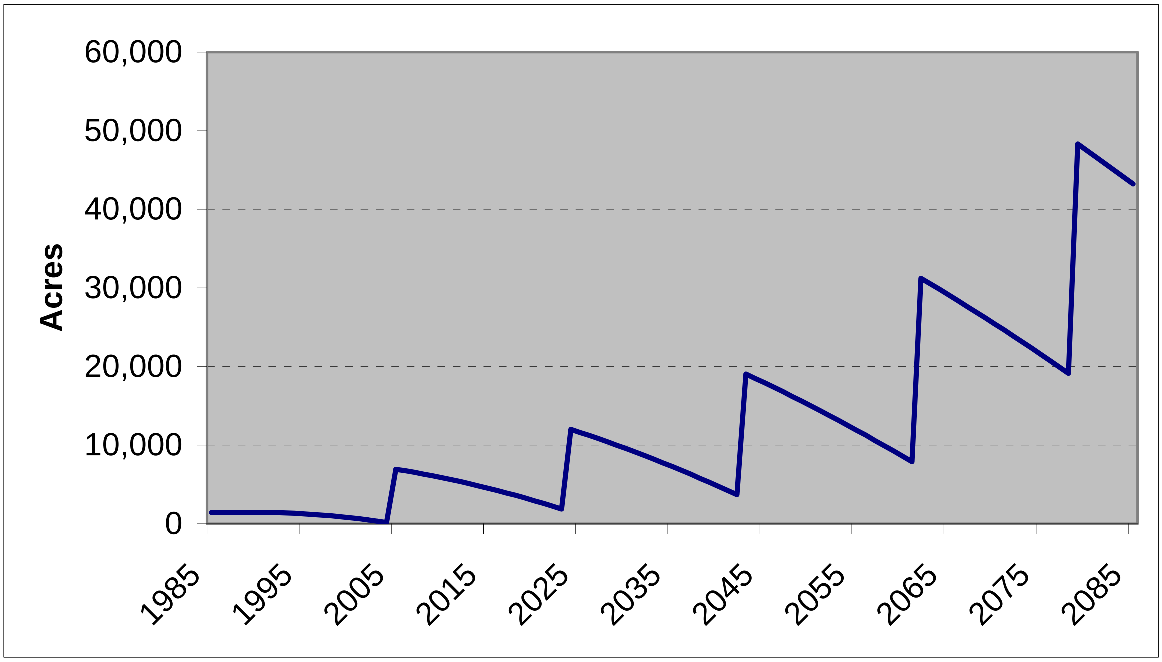


The increasing rate is driven by two factors: 1) population growth; and 2) neighbor interactions. Population grows exponentially such that in every year more new people are added to the population than in the previous year. This implies that restricted land

[6] All agricultural land is the sum of restricted agricultural land and developable agricultural land.

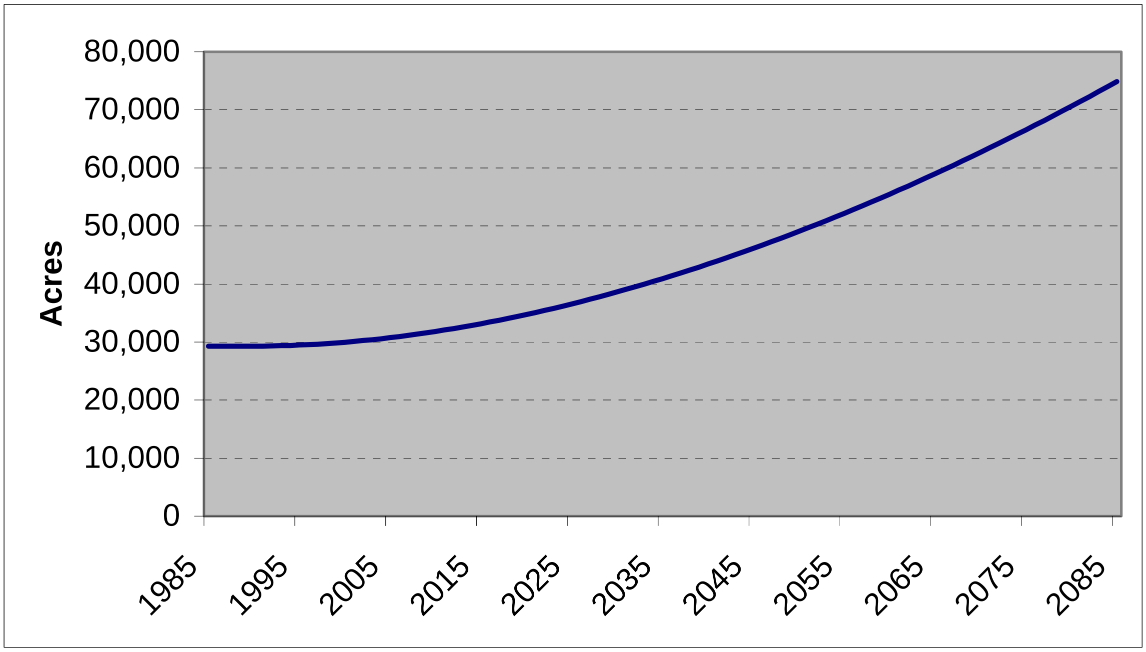
will be converted to developable land at an increasing rate in order to accommodate the necessary increases in the UGB (Figure 30).

Fig. 30
Baseline Simulation – Developable Land



The trend in developable land depicted in Figure 30 highlights the relationship between land use policy and land conversion. The spikes represent increases in the UGB. The UGB is assumed to be updated every 20 years to accommodate estimated population growth. These policy induced incremental increases in the amount of developable land grow subsequently larger over time in order to accommodate the exponentially growing population. The periods of decline in between policy adjustments depict the conversion of developable land to development. Conversion occurs at an increasing rate as time elapses due to the increasing effect of neighbor interactions. Figure 31 illustrates the increasing accumulation of developed land.

Fig. 31
Baseline Simulation – Developed Land



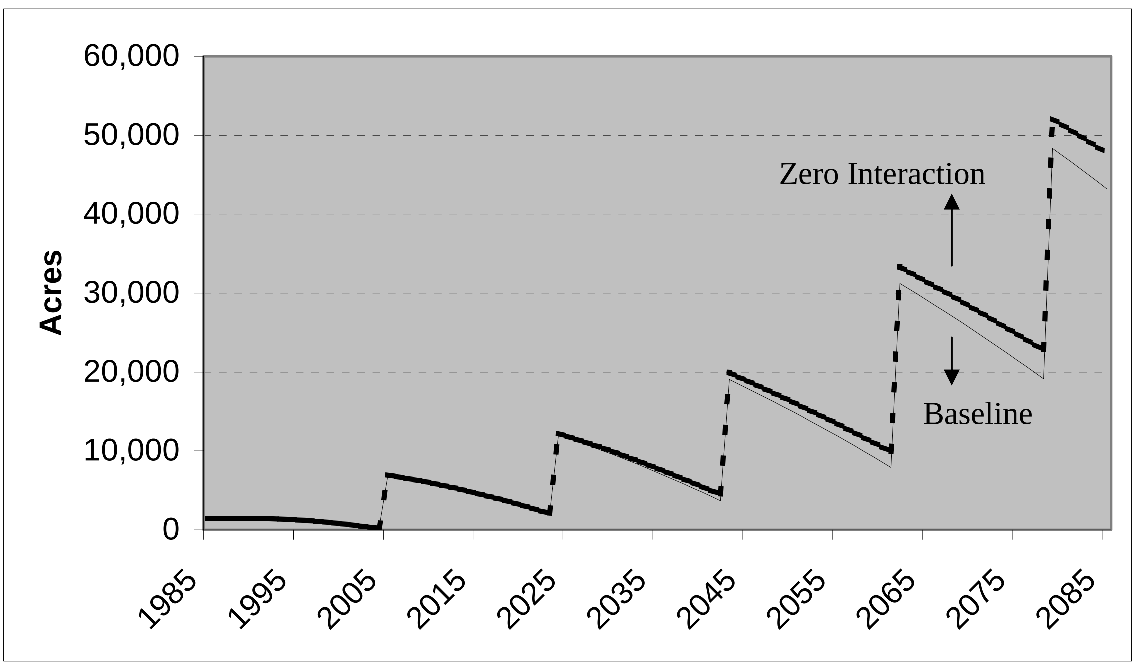
The baseline simulation highlights the models' ability to explore land conversion over time. Although its precision is highly dependent on data quality and availability, the model's potential as a learning tool and policy mechanism is self-evident. The next section will further highlight the models' potential by simulating land conversion under alternative assumption and policy adjustments.

4.2.2 Simulating Alternative Assumptions and Policy Adjustments

Dynamic simulation models are well suited to exploring theoretical changes to the underlying assumptions. The land conversion model allows users to readily alter assumptions or simulate potential policy changes and quickly observe the implications of the changes. This section will present two changes that emphasize the model's capability.

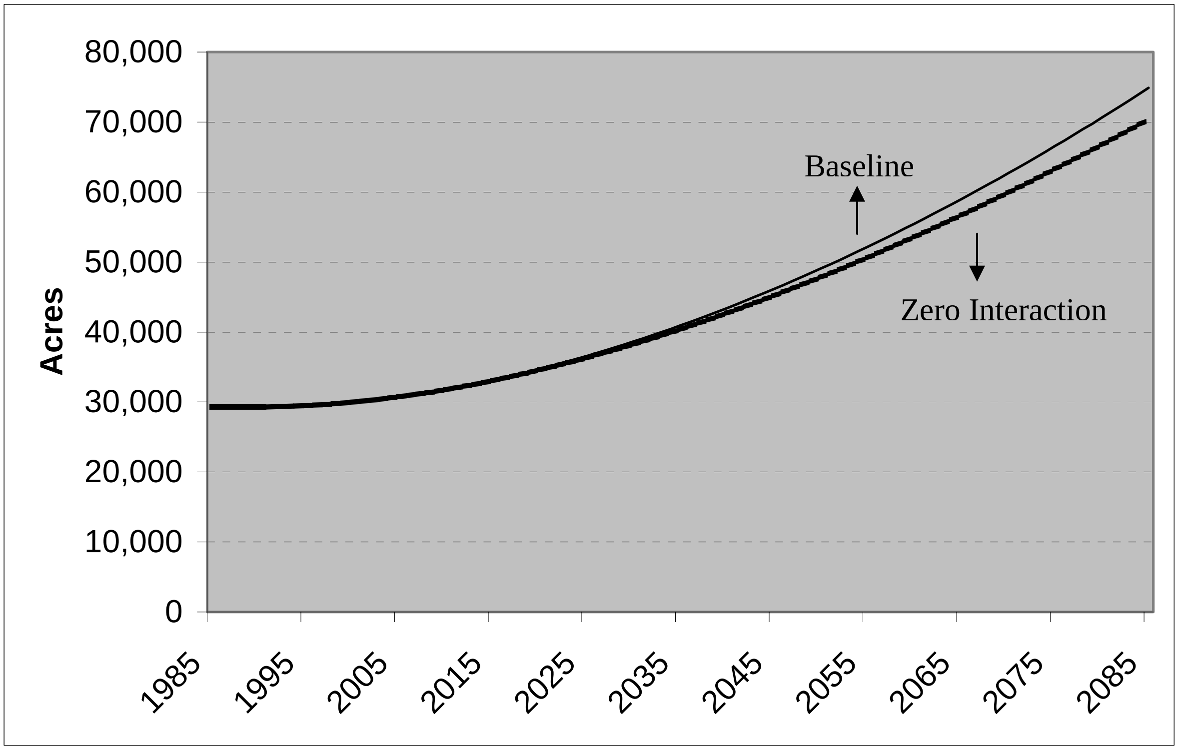
One of the key assumptions in the model is the degree of neighbor interaction. The baseline assumption of 0.015 implies that for every acre lost to development the average expenses of the remaining agriculturists in the county will increase by $15.00. If it were believed that producers had little or no dependence on neighbors, then the conversion of land to development would have no impact on expenses and agricultural profitability would not be impacted by the conversion of neighboring lands. As a result, developable land will be converted at a slower rate (Figure 32).

Fig. 32
Developable Land without Neighbor Interaction Effects



As expected, Figure 32 depicts more land remaining in agricultural use without the impact of neighbor interactions. With no neighbor interaction effect, farmers are more likely to remain producing as neighboring farms are converted to developed land. Similarly, the quantity of land developed increases at a slower rate (Figure 33).

Fig. 33
Developed Land without Neighbor Interaction Effects



Alternatively, neighbor interactions might constitute a large cost savings for producers. If expenses were highly affected by the loss of neighbors, i.e. the conversion of developable land to developed land, then agricultural land would be converted more rapidly (Figure 34, Figure 35).

Fig. 34
Developable Land with Large Neighbor Interaction Effects

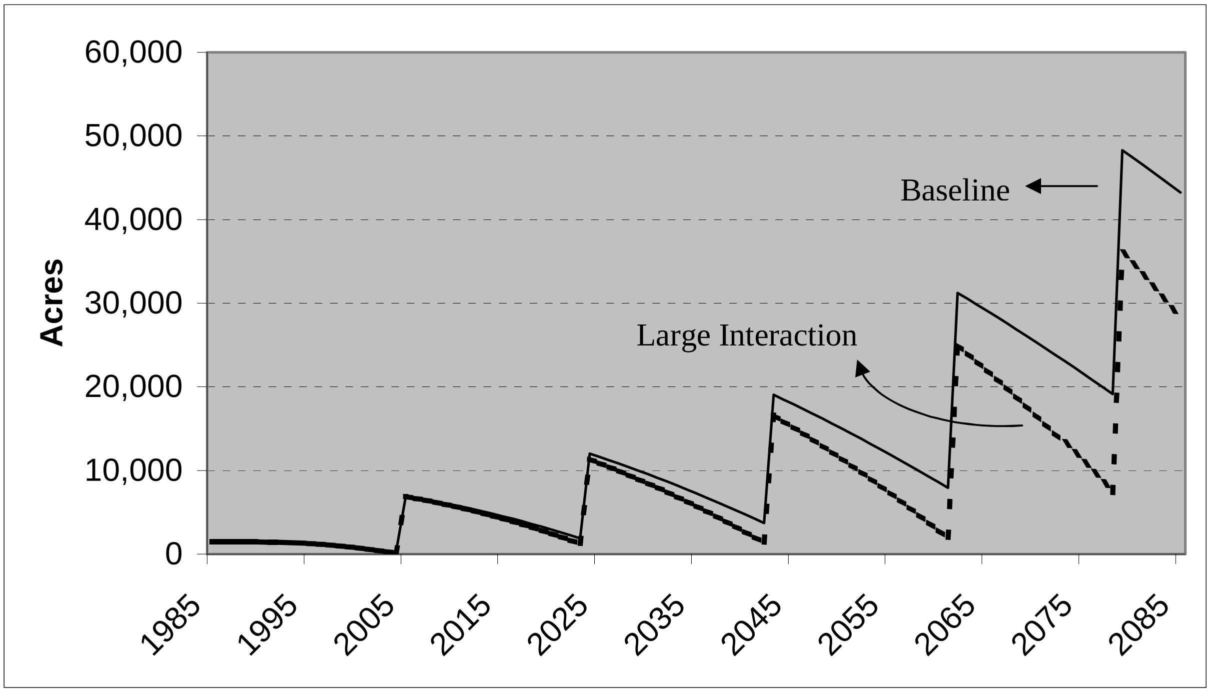
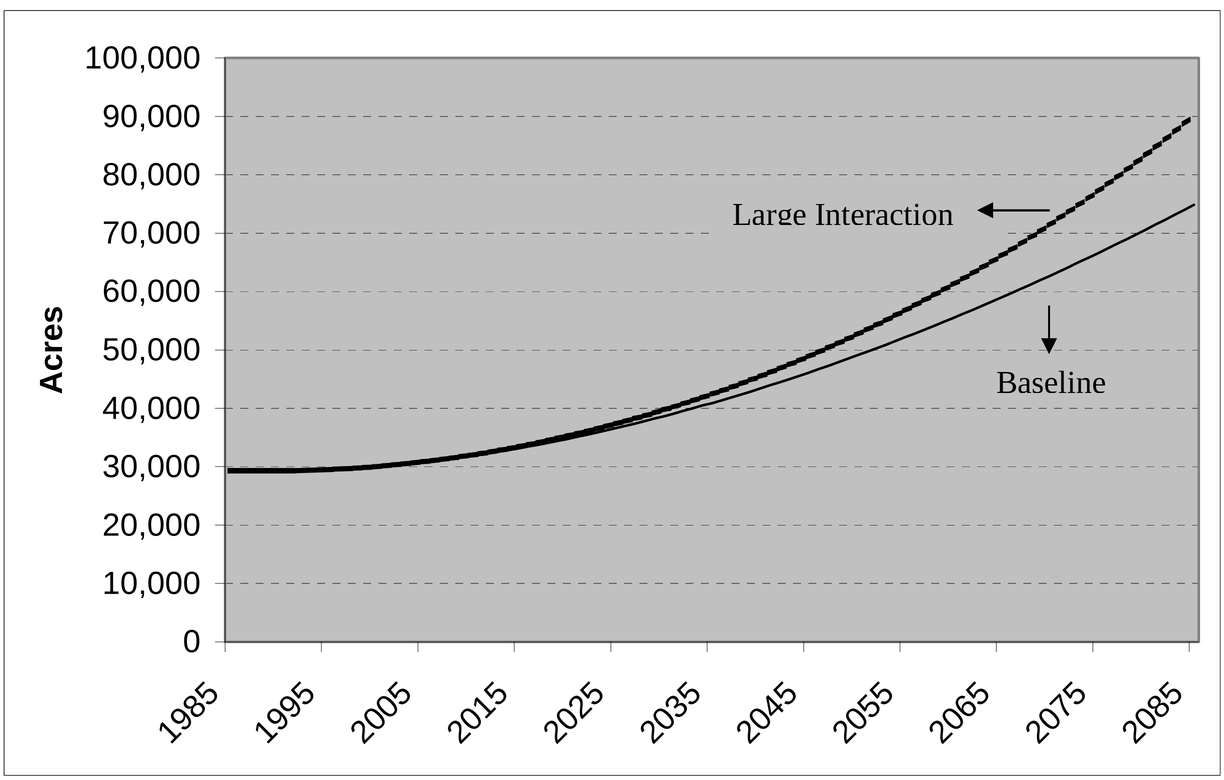
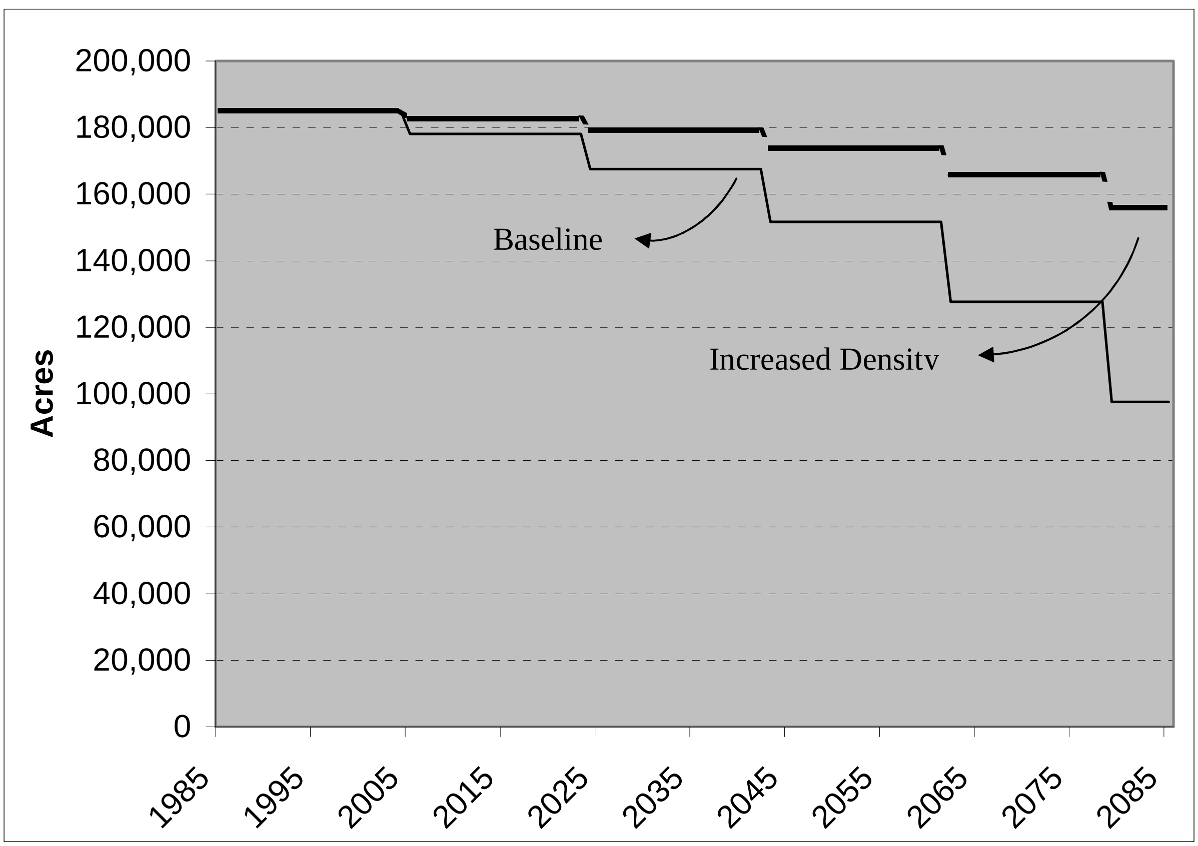


Fig. 35
Developed Land with Large Neighbor Interaction Effects



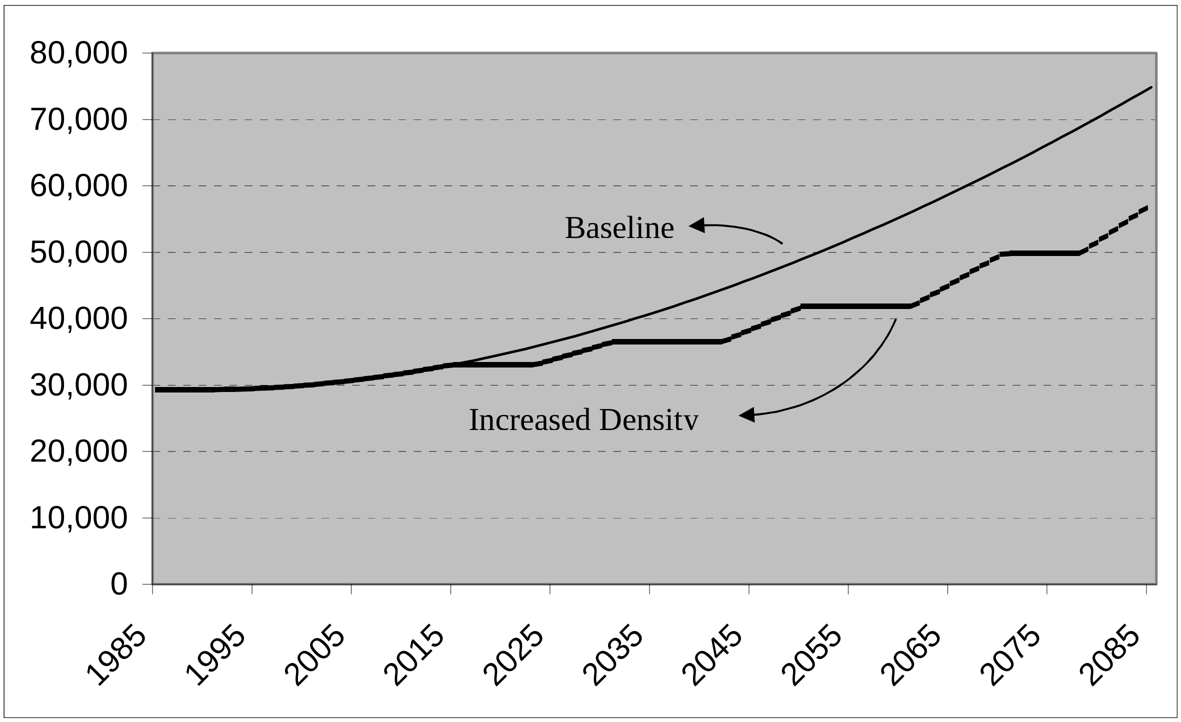
In addition to allowing users to become intimately familiar with the implications of altering underlying assumptions, the model is well suited for considering the affects of proposed policy. For example, consider a policy intended to slow the conversion of agricultural land by increasing the density of development. This type of policy would allow influxes of new people to reside on less land. In the simulation model this policy implies a reduction in the land needs factor. Figure 36 illustrates the simulation of restricted agricultural land for the baseline land needs factor of 0.30 and a policy induced decrease in the land needs factor to 0.10.

Fig. 36
Restricted Agricultural Land with Increased Development Density



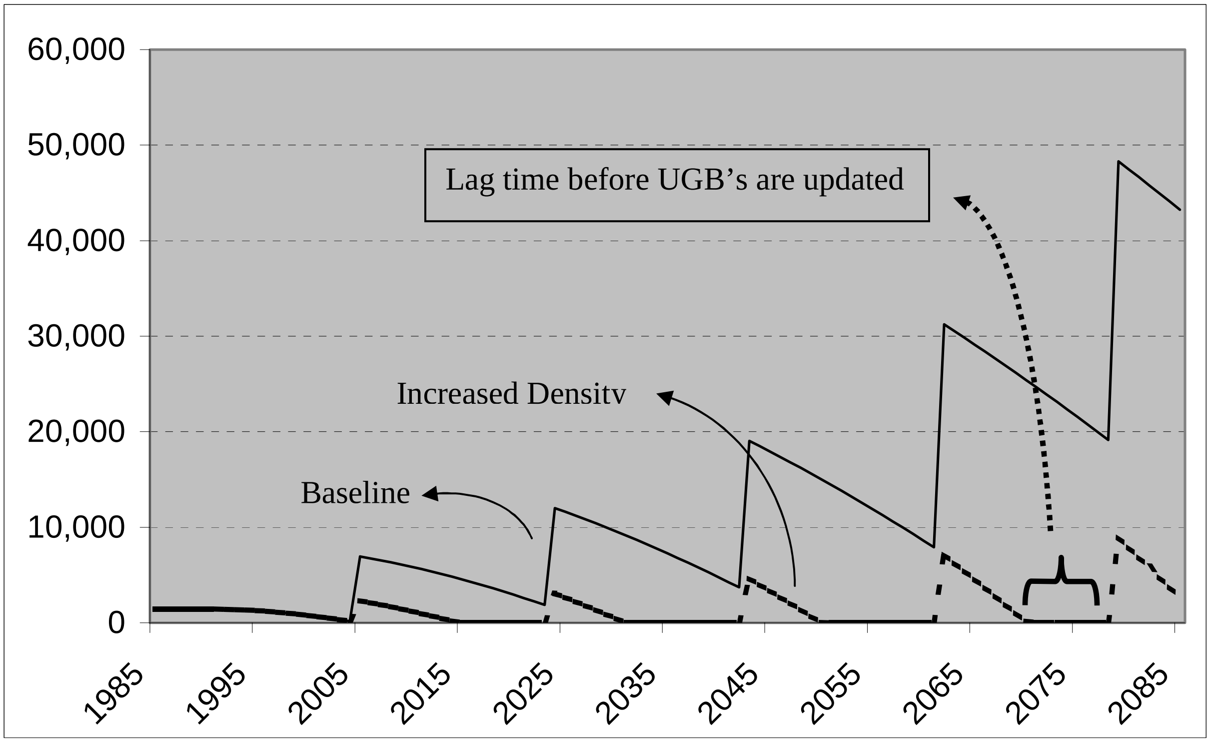
The decreased land needs factor allows restricted agricultural land to be preserved for a extended duration since population growth places less pressure on policy makers to increase the UGB. With less land available for development, developed land increases at a slower rate (Figure 37).

Fig. 37
Developed Land with Increased Development Density



The lag periods in conversion to developed land correspond to periods where there is not enough developable agricultural land available to satisfy the demand for development. Once UGBs are updated and there is an inflow of developable land it begins to be developed (Figure 38).

Fig. 38
Developable Agricultural Land with Increased Development Density



5. Future Directions

The pilot project in Polk County, Oregon has resulted in a land conversion simulation model with great potential as a learning tool and policy instrument. The result is a user-friendly model, which allows all users to easily consider the implications of the interrelationships in small agricultural communities on the conversion of agricultural land. Even in the absence of abundant data, and with somewhat crude assumptions and parameters, the DSM provides plausible results that allow users to understand how agricultural infrastructure interacts with land use policy to affect the rate of farmland conversion.

Future research goals will direct the improvement and refinement of the model. In order to increase the model's predictive power, future modeling efforts should:

1. Uncover more refined data sources with attention towards a time series of accurate acreages within each land use type.
2. Conduct a complete and statistically accurate survey in order to better understand the functional relationships governing neighbor interactions.

To facilitate the model as a learning tool, future research should:

1. Continue to develop the user-friendly capabilities of the STELLA modeling software.
2. Maintain simple functional relationships whenever it is possible without large costs to the model's predictive power.

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Appendices

A.1 Agricultural Producer Survey

Sample surveys are an integral part of empirical and applied research in most social science disciplines (Rossi et al., 1983). This section describes the survey process in order to facilitate future replication. Whenever appropriate, special attention is given to the positive and negative aspects of the process so that future surveys can be modified appropriately. Before addressing specific concerns regarding the survey used in this report some general areas for future improvement are considered.

First, future surveys must address sample selection issues. A large random sample will provide unbiased estimates that can be confidently used in the modeling process. Future survey design should attempt to illicit more specific financial information about neighbor interactions and production expenses. Higher quality financial data will facilitate improved functional specifications regarding the relationship between the conversion of farmland and the remaining producers expenses. This improved data quality can further the simulation model's ability as a predictive tool for land use planners. Finally, information on individual decision to exit production would provide future researchers a better understanding of the agricultural land conversion process, which could again be employed to improve the model's predictive power.

The survey process use in this report can be broken down into three steps: 1) questionnaire design; 2) sample selection; and 3) survey administration. The agricultural producer survey was designed to elicit both qualitative and quantitative information on the agricultural infrastructure in Polk County. Specifically, the survey contains 73 questions divided into seven sections intended to address specific topics of interest (see Table A1). Sections A and B ask general questions about the operators' farm characteristics, production history, and land use practices. Sections C and D address the operators' relationship with both farming and non-farming neighbors. Section E addresses the operators' long-term production plans. Section F inquires about the financial aspects of the farm operation. Lastly, section G addresses the operators' relationship with agricultural processors and input suppliers.

Table A1.
Summary of Agricultural Producer Survey Topics

	Topic
A	Farm Characteristics, Land Use Practices and History
B	Farming Practices
C	Local Farmers' Relationships
D	Economic Transactions with Neighbors
E	Long-term Production Plans
F	Farm Financial Characteristics
G	Relationship with Processors and Input Suppliers

Before future replication, design modifications should be considered. Although survey respondents easily understood and responded favorably to the majority of the questions, they found questions requiring the use of county and state maps difficult to answer. These questions were intended to provide information about the size of the local agricultural infrastructure and the distance to processors and input suppliers. These issues can be addressed by requesting the operator to state a location (township or city) in lieu of the map approach. Respondents found this approach acceptable. Additionally, section B could be more efficiently addressed by moving questions B1-B3 into Section A and questions B4-B6 into Section C.

Sample selection was accomplished in conjunction with the Oregon Farm Bureau (OFB). First, a list of 50 farm operators was generated and contacted via mail by the OFB. This initial contact informed operators of the purpose of the project and its legitimacy through the affiliation with OFB and AFT. Based on response to initial contact, 30 operators were selected to perform the survey. Due to time constraints, the sample was selected without attention to sample selection bias. As such, the current survey results cannot be generalized to a larger population.

Survey administration was accomplished in two phases. First, the 30 operators were contacted via telephone to schedule interviews. Interview scheduling should be done no more than two weeks in advance for ease of scheduling and a reminder call should be given within 24 – 48 hours. Interview scheduling was complicated by operators' production schedules. Future interviews should attempt to schedule in order to accommodate busy seasons such as harvest.

Lastly, surveys were administered according to the scheduled appointments. Interviews ranged from 30 minutes to one hour in length and strict scheduling allowed all interviews to be completed in one month's time. The survey administrator found that interviews were improved when the administrator filled out the form for the respondent and was willing to allow the respondent to continue with their daily routine.

A.1.1 Summary of Survey Responses

Section A

A1) What are the major types of services or products which you sell? (List major ones, e.g. livestock, hay, row crops, custom work)

Respondent	Primary Products Listed
1	heifers/cows/milk
2	grains/grass seed/cattle/legumes/clover
3	grass seed/custom work
4	tree nursery stock/custom work
5	grass seed/trucking/cow/calfs/beef/storage unit
6	lambs/wool
7	grapes
8	wheat/grass seed/clover seed/sheep/fir trees
9	milk/culled cows/computer programs
10	silage/grass seed/field corn/dairy feed/beef animals/hay
11	grass seed/wheat/alfalfa
12	silage/wheat/grass seed/custom work
13	beef/grass seed
14	sweet cherries/prunes/custom work
15	grass seed/grain/custom processing
16	grass seed
17	wheat/grass seed/clover seed/livestock/straw/trucking/hauling
18	vegetables/tree nuts/small grains
19	milk/beef
20	grass seed/grain/blueberries
21	hay/manure/mowing/fryers
22	grass seed/wheat
23	forage/grass seed/wheat/cattle
24	wheat/grass seed/mustard/vegetables
25	prunes/oats/small grains/hay/wheat
26	produce/hay/horses
27	animal services: training, boarding, lessons
28	hay/tractor work/ground site prepping
29	grass seed/wheat/silage corn
30	beef/cattle

Primary Products by OAIN Category

OAIN Category	Number of Respondents
Grains	10
Hay & Forage	5
Grass & Legumes	16
Field Crops	2
Tree Fruit & Nuts	4
Small Fruit & Berries	1
Vegetables & Truck Crops	3
Specialty Products	2
Livestock & Poultry	14

A2) *How much leased or owned acreage do you farm upon?*

Minimum Acreage: 6
Maximum Acreage: 1660
Average Acreage: 513.95

A3) *Is the land contiguous in nature?*

Number of “yes” responses: 8
Number of “no” responses: 22

A4) *If no: What percentage of your land used for agricultural production can be reached in ______miles (one-way) from your home base block of land.*

100% in 1-2 miles
50% in 1-2 miles & 50% w/in 3-7 miles
85% in 1-2 miles & 15% w/in 3-7 miles
50% in 1-2 miles & 30% w/in 3-7 miles & 20% in 8-15 miles
50% in 1-2 miles & 50% w/in 3-7 miles
100% in 1-2 miles
20% in 8-15 miles & 80% w/in 16-25 miles
25% in 1-2 miles & 75% w/in 8-15 miles
100% in 1-2 miles
100% in 1-2 miles
90% in 1-2 miles & 10% w/in 16-25 miles
90% in 1-2 miles & 10% w/in 16-25 miles
100% in 1-2 miles
100% in 8-15 miles
25% in 1-2 miles & 75% w/in 3-7 miles
100% in 1-2 miles
50% in 1-2 miles & 50% w/in 3-7 mile
100% in 1-2 miles
100% in 1-2 miles
60% in 1-2 miles & 40% w/in 3-7 miles
90% in 1-2 miles & 10% w/in 3-7 miles
40% in 1-2 miles & 60% w/in 3-7 miles
80% in 1-2 miles & 20% w/in 3-7 miles
100% in 1-2 miles
100% in 1-2 miles

100% in 1-2 miles
100% in 1-2 miles
100% w/in 4 miles
50% in 1-2 miles and 50% w/in 3-7 miles

A5) *Do you own all of the land you have farmed upon in the past five years?*
Number of "yes" responses: 7
Number of "no" responses: 23

A6) *If no: How much of the aforementioned worked-upon acreage was rented in the past five years (on average)?*
Average acreage rented: 252.5

A7) *Have you lost any rented acreage to non-agricultural development projects in the past five years?*
Number of "yes" responses: 6
Number of "no" responses: 18
Number of "n/a" responses: 6

A8) *If yes, how many acres of your rented land were developed within the last five years?*
Average number of acres developed: 32.8

A9) *Into what classification was the land converted?*

	Number of Responses
Commercial developments	2
Housing developments	2
Mining	0
Conservation purposes	1
Other (please specify)	Highway

A10) *With the reduction of your land-base, did you rent or buy additional land to supplement your loss?*
Number of "yes" responses: 3
Number of "no" responses: 3
Number of "n/a" responses: 24

A11) *If no, did this force you to scale back your operation in production capacity?*
Number of "yes" responses: 1
Number of "no" responses: 2

A12) *If yes, as of 2002, are you at the same level of production you were at five years ago?*
All three "yes" respondents were at the same or higher level of production.

A13) If no, how were you able to compensate for the loss caused by the decreased acreage?

All three "no" respondents failed to compensate for the lost acreage.

A14) Has your number of acres farmed increased in the past five years?

Number of "yes" responses: 10
Number of "no" responses: 20

A15) How close is your base of operations located to an Urban Growth Boundary?

Minimum Distance: 300 yards
Maximum Distance: 17 miles
Average Distance: 5 miles

A16) Have you ever sold acreage knowing it would be converted to non-Ag uses?

Number of "yes" responses: 3
Number of "no" responses: 27

Section B

B1) How did you get into farming

Family Business: 26
Other: 4

B2) Are you growing the same products you were raising five years ago?

Number of "yes" responses: 26
Number of "no" responses: 4

B3) Are you employing the same farm management practices you were five years ago?

Number of "yes" responses: 20
Number of "no" responses: 10

B4) Have you ever had to change your farming practices because a neighboring farmer complained?

Number of "yes" responses: 10
Number of "no" responses: 20

B5) If yes: How did this affect you financially?

Costs were increased for nine of the ten respondents in question B4.

B6) Have you ever had to change your farming practices because a non-farming neighbor complained?

Number of "yes" responses: 13
Number of "no" responses: 17

B7) *If yes: How did this affect you financially?*

Responses centered on increasing costs, such as switching to more expensive chemicals, and decreasing efficiency, such as fallowing fields to avoid conflict.

Section C

C2) What is your relationship to farmers in your area? *(Please tick all those that apply)*

Relationship	Number of Respondents
Acquaintance	16
Friends	27
Family	9
None	0

C3) *(Please tick all those that apply)*

Activity	**Number of Respondents**
Rent Land from	17
Rent Land to	5
Trade Land	6
Share Advice	30
Financially Benefit from Shared Knowledge	28
Hesitant to Ask Other Farmers for Advice	7
Help when Incapacitated	11
Mentor to	14
Mentee	16
Thinks Advising Hurts Your Business	4

C4) *Have you ever been adversely affected by another farmer's actions?*

Number of "yes" responses: 14

Number of "no" responses: 16

C5) *If yes: What types of actions have proven detrimental?*

Responses

spray drifts, weed-throwing, incorrect disposal causing water problems

spray drifts

spray drifts

leaving gates open, knocking down fences

one person came in and flooded market w/ product, thereby decreased the overall prices

driving through fields and damaging your crops

destruction of property

drift problems

run over crops and irrigation pipes

very rare: bad management brought in disease that spread to his farm

another farmer created a wetland
wetland was created in nearby field
tearing out property lines
their inability to control their run-off killed his grass seed--farmer was not following DEQ rules
some allow weeds to run rampant

C6) Did this hurt you financially?

Number of "yes" responses: 13
Number of "no" responses: 1

C7) Have you ever been adversely affected by the actions of a non-farming neighbor?

Number of "yes" responses: 11
Number of "no" responses: 16
Number of "n/a" responses: 3

C8) If yes: What types of actions have proven detrimental?

Responses

time spent in diplomacy
run-off road and hit fence, then they fled
non-aggies have no idea of how farming works; as a result they don't give allowances to farms. They don't realize it is a business trying to survive
lawsuits have ensued//non-agriculturists don't understand how farming works, hypocritical actions
lawsuits//land disputes//loss of time and money
driving through fields
complaints to gov't regulators
horses got into field and damaged crops
didn't agree w/ his farming practices
people who are litigious in nature serve to make farmers' lives miserable -- they don't understand farming

C9) Did this hurt you financially?

Number of "yes" responses: 10
Number of "no" responses: 1

Section D

D1) Which, if any, of the following economic transactions have you participated in with farmers? (Please tick all those that apply)

	Number of Responses		
	Rarely	Sometimes	Usually
Buy Goods from	13	7	10
Sell Goods to	10	11	9
Peform Custom Work	11	8	11
Receive Custom Work	11	10	9
Share Equipment	10	8	12
Joint Harvest	16	5	4

D2) What percentage of your income derives from interactions with other farmers in your county?

Percentage	Number of responses
0 - 10%	23
11 - 20%	3
21 - 30%	0
31 - 50%	2
51 - 75%	1
76 - 100%	1

D3) Can you indicate on a map of Polk County where you buy your goods from other farmers?

Responses

next door neighbor
w/in five mile radius of their home base
Rickreall, Suver, W. Salem
Independence
Rickreall area and Buena Vista
w/in 3 miles
Dallas
Rickreall
Independence
Suver, Independence
Perrydale, Rickreall, Ballston, w/in 7 miles
Rickreall
Rickreall
Red Prairie, Rickreall, Independence, Dallas
w/in 1-2 miles
Suver and w/in 1 mile
Monmouth, Suver: all w/in 10 miles
Dallas area, as far as 20 miles away

Can you indicate on a map of Oregon where you buy your goods from other farmers?

Responses

Klamath County
w/in 50 miles of their home base
Albany, McMinnville, Corvallis, Portland, St. Paul, Yakima
Corvallis
Salem, Klamath Falls, Christmas Valley
Sublimity and Albany
N. Eastern Oregon
St. Paul, Harrisburg, Junction City
Junction City
Fall City
Marion County

Yamhill County
Corvallis
up to 250 miles away into Eastern Oregon

D4) *Can you indicate to me on a map of Polk County where you sell your goods to other farmers?*

Responses
n/a
all of Polk County
very rarely--howevery when he does it is in all corners of Polk County
Rickreall
Rickreall
Rickreall
w/in 3 miles of home base
Greenwood
Rickreall
w/in 5 miles
Rickreall and Independence
Dallas, Salt Creek, Kings Valley: all over Polk county
Rickreall, Independence, Monmouth
Rickreall, Independence, Monmouth
next door
w/in 1-2 miles
w/in 10 miles
Monmouth, Suver: all w/in 10 miles
Dallas, Fall City--20-30 miles from home base

Can you indicate to me on a map of Oregon where you sell your goods to other farmers?

Responses
Coos County
Halsey, Albany, Forest Grove
McMinnville
Salem
Albany and Portland
Portland, Tangent and Albany
Portland
Yamhill County
Rufus, Unity
Lebanon, Woodburn
w/in Marion and Yamhill County
Ohio, WA, all over U.S.
Marion County

D5) Can you indicate to me on a map of Polk County where the operations bases are of those agriculturists you hire to perform custom service work for you?

Responses

Independence//all others w/in 5 miles
w/in five mile radius of their home base
w/in 10 miles--especially W. Salem
w/in 1/2 mile
Rickreall
Salem and Perrydale
Rickreall and areas w/in 10 miles
w/in 5 miles of home base
Greenwood
Rickreall
Rickreall
w/in a 5-mile radius
Independence: all w/in 10 miles of home base
w/in 3 miles
Rickreall
Rickreall
Rickreall
Rickreall and w/in 5 miles of home base
all w/in 10 miles
all w/in 5 miles

Can you indicate to me on a map of Oregon where the operations bases are of those agriculturists you hire to perform custom service work for you?

Responses

Blodgett
w/in 10 miles
Salem, St. Paul
Jefferson, up to 30 miles away

D6) Can you indicate to me on a map of Polk County where you perform your custom service work?

Responses

w/in five mile radius of their home base
w/in 5 miles--especially W. Salem
Rickreall//Suver/all over
w/in 5 miles
all around the state
all over Kings Valley
w/in a 1/3 of a mile
Greenwood
Buena Vista, Dallas, Independence
Dallas area and w/in 5 miles of their home base
Rickreall
w/in a 5 mile radius
w/in 10 miles
w/in 6 miles

w/in 2-3 miles
next door
all over the County
all w/in 10 miles
w/in 5 miles
all w/in 2-3 miles

Can you indicate to me on a map of Oregon where you perform your custom service work?

Responses
Linn, Yamhill, and Marion Counties & Sheridan
w/in 20 miles
all around the state
Klamath Falls, Lane and Marion County
Yamhill County in years past
w/in 6-8 miles
Eugene, Clackamas

D7) Can you indicate to me on a map of Polk County where the operation bases are for those agriculturists borrow machinery from or lend to?

Responses
next door neighbor
w/in five mile radius of their home base
they lend, but do not borrow
w/in 5 miles
next door
w/in 1-2 miles
Salem, but all w/in 7-10 miles of their home base
all w/in 10 miles
Greenwood
Independence and Buena Vista
Rickreall
w/in 3 mile area
w/in 2 miles
w/in 2 miles
w/in 6 miles & St. Paul
w/in 10 miles of Dallas
Independence, Rickreall
Independence, Rickreall
w/in 1-2 miles
next door
w/in a 1/2 mile
all w/in 5 miles
1 mile away

D8) Approximately how much money do you believe you have saved over the past 10 years by sharing or borrowing machinery from other agriculturists?

Minimum Saving: $0
Maximum Saving: $300,000
Average Saving: $26,667

D9) Have you ever participated in a joint-harvest with any farmer in your county?

Number of "yes" Responses: 10
Number of "no" Responses: 20

D10) If yes: How did it work?

Responses

it was an emergency situation--the idea is just to help out your fellow man

share the growing and harvesting--they have equipment and he has the land and crop

he hauls and chops for them, and they will work up his ground and then plant his crops

the idea is to just help each other out--it's a give and take situation

once a year he helps out another farmer

one man got hurt, so a bunch of farmers came together to assist him

one farmer harvests all the grains, other farmer harvests all of the beans

operation w/ father: it is a joint harvest

works w/ child--so all harvesting is done w/ them

the neighbors work together to get all harvesting done in one fell swoop

w/ Christmas trees they are all done at the same time: first neighbors place, then their farm

he cuts, his neighbor then rakes the fields

all the neighbors share trucks, pickers, etc. when shipping to canneries

D11) What do you think about the idea of local farmers giving each other slight breaks in price when selling a service or product because the two individuals are acquainted with one another?

Most farmers believed that it was a good idea as long as it was affordable.

D12) Have you ever heard of anyone partaking in such a transaction?

Number of "yes" Responses: 27
Number of "no" Responses: 3

D13) Have you ever participated in such a transaction?

Number of "yes" Responses: 26
Number of "no" Responses: 4

D14) Do you ever barter for goods and services with farmers?

Number of "yes" Responses: 18
Number of "no" Responses: 12

D15) Can you think of other economic transactions you have with other farmers?

Responses

chemical pricing
volunteer services to local non-profits in including FFA, 4-H
they help one another out, but they always keep track of the hours each farmer works
they also buy and sell cows
acting as a broker for other farmers

Section E

E1) How many more years do you expect to be farming?

Minimum:	3
Maximum:	60
Average:	22

E2) What is your current age?

Minimum Age:	21
Maximum Age:	73
Average Age:	51

E3) Do you have any exit possibilities if you decide to liquidate your operations (e.g., sell land to developers, give/sell land to your children, neighbors).

Responses

children
the land may go to children
land-grabbers, children and/or neighbors
children
doesn't have any
auction
try to find a new vineyard manager
kids
neighbors
family
neighbors--people out of the area
kids
open market
neighbors/developers
developers
environmental groups or children
neighbors
family and neighbors
family
neighbors/other farmers
all the stated options
developers, kids
auctions
kids
neighbors/children

E4) *If you decided to sell your land, are you willing to accept less money from a buyer to ensure that your ground stays in agricultural production?*

Number of "yes" Responses: 16
Number of "no" Responses: 14

E5) *Why or why not?*

The majority of "yes" respondents believed that it was important to preserve agriculture and would be willing to do their part. "No" respondents either felt that they could not afford to give price breaks; wished to get their just returns from their land and labor; or felt that if they failed it was not reasonable for someone else to attempt further production on their land.

E6) *Do you have children?*

Number of "yes" Responses: 29
Number of "no" Responses: 1

E7) *Do you anticipate your children taking over your farming operations?*

Number of "yes" Responses: 21
Number of "no" Responses: 8

E8) *If yes: Do you feel that would be a financially stable job for them to take?*

Number of "yes" Responses: 15
Number of "no" Responses: 6

E9) *Could you explain your reasoning?*

Responses

they are well-educated in ag

you can see farming in a "cup-half-full or half-empty" mentality: true, you don't have a lot of extra money, but you DO have the opportunity to have a job that you are passionate about

they aren't paid according to how hard or long they work, but rather their pay is based on forces of the market that they have no control over

the effective marketing techniques that his children had have picked-up over the years will help to keep their ag business sustainable.

it would depend on their management skills, it is tough to go into ag--however, at the present moment, the farm is an economically viable unit

if they could maintain the current amount of acreage, then maybe--farming is just a way of life, it has to be a personal, not a financial decision to produce agricultural products.

farming is a way for life--you don't farm for the money

unless something bad happens to the economy.

prices make farming almost unlivable

economic factors are against you--the state gov't under our Governor has been anti-ag

as long as the current ag climate is maintained

the farm has good water, paid for land, and adequate machinery--unless whole area turns topsy-turvy, kids shouls be able to farm. His children might have to reduce their lifestyle, but they could still farm.

people will always need food

For the amount of capital investment and returns, it is a foolish business investment. It used to be that farming was self-sufficient; now it is just profit and loss.

it all hinges on how the poultry industry goes

it has worked for years and the only cause for concern would be the intrusion of non-ag developments and the impending conflict and policy concerns

it is his philosophy that someday farm ground will be in such short supply, that having EFU will ensure an income

it has already worked for five generations

it is very labor intensive compared to the income--staying in ag would depend on the reputation of the business in the future

having timber would allow his children to stay in faming

machinery and initial investments are already taken care of--they could just focus on faming

E10) *Do any of your neighbors have children who will carry on the farming operations at their current locations?*

Number of “yes” Responses: 26
Number of “no” Responses: 4

Section F

F1) *How many contributing to household income individuals lived in your household for six months or more in 2002?*

Minimum Individuals: 1
Maximum Individuals: 6
Average Individuals: 2

F2) *Of these, how many were employed outside of the farming operation?*

Minimum Individuals: 1
Maximum Individuals: 2
Average Individuals: 0.4
*30% of farms responding reported as least one household member earning off-farm income

F3) *What were the occupations or lines of work of those employed outside of the farm operations in 2002?*

Responses
receiving retirement benefits
church secretary
sign interpreter
insurance office
cartographer
teacher
policeman and other farm employee
university employee
in-house sewing business, farm bureau

education consulting
desktop publisher

F4) Did you operate any kind of small income producing business out of your home in 2002? Examples might include babysitting, selling handmade crafts, etc.

Responses

computer work
sewing business
desktop publisher

F5) In which of the following categories did your total pre-tax net farm income fall in 2002? Please include all wages and salaries, dividends and interest, rental earnings, social security, household earnings, etc. (Please tick the appropriate line)

Income Category	Number of Responses
< $10,000	10
$10,000 - $30,000	6
$30,000 - $60,000	4
>$60,000	8

F6) About what percentage of your total household income in 2002 was from wages, salaries, and other earnings paid by Polk County businesses, Polk County government units, or other local public organizations, etc.

Minimum Percentage:	0
Maximum Percentage:	99
Average Percentage:	24

Section G

G1) Can you indicate to me on a map of Polk County the locations of the agricultural supply dealers that you frequent?

Responses

Rickreall, neighbors, W. Salem
Rickreall, Amity, Monmouth, Salem
Rickreall, Suver, W. Salem and Independence
Rickreall
Rickreall, Dallas
Rickreall, Suver, W. Salem
Rickreall
Independence, Rickreall
Rickreall, Suver, W. Salem
Rickreall, Monmouth
Rickreall, W. Salem
Rickreall, W. Salem
Rickreall

Rickreall

Rickreall, W. Salem

Rickreall (95%)

Independence, Suver, Rickreall

Suver, Rickreall, W. Salem

Rickreall, Independence, Dallas

Rickreall, Dallas

Rickreall, Independence, Dallas, W. Salem

Rickreall, Independence, Dallas, W. Salem

Rickreall

Rickreall, Dallas

Rickreall, Dallas, Independence, W. Salem, Monmouth

Rickreall

Independence, Dayton, Rickreall, Dallas, W. Salem

Rickreall, Suver, Monmouth: all w/in 10 miles of their home base

Rickreall, Dallas, Suver: all w/in 20 miles of home base

Can you indicate to me on a map of Oregon the locations of the agricultural supply dealers that you frequent?

Responses

St. Paul, Berenberg, Tillamook

Rarely in Eastern Oregon

Albany, Tangent, Salem

Western Oregon

Albany, Tangent, Portland, McMinnville, Corvallis

Mt. Angel, McMinnville

Brooks, McMinnville, Amity, Molalla

Salem, Albany, Portland, Eugene

Salem, Albany, McMinnville

McMinnville

Tangent, Hood River, Salem, Eugene, CA

St. Paul

Salem, Woodburn, Albany

OSU, Salem, Linn County, Albany, Corvallis

Marion County: all w/in 25 miles of home base

Salem, McMinnville

St. Paul, Salem, St. Paul

St. Paul, Salem, St. Paul

McMinnville, Sheridan

Yamhill County

PA

Silverton, McMinnville, Albany

Marion County, Salem

Corvallis, Salem: all w/in 20 miles of their home base

Salem, Woodburn

G2) *Could you please list the types of agricultural businesses from which you buy? (i.e. equipment, chemicals, etc.)*

Responses

equipment, seed, irrigation, supplies for dairy cows
irrigation, AgWest, implements
John Deere, Ag West, New Holland, Mack Distributor, Wilbur-Ellis, Western Farm
equipment, fertilizer, nursery supplies, seedlings
implements, chemicals, hardware, building supplies
chemicals, equipment, fuel, fertilizer, feed, drugs
chemicals, equipment
equipment, fertilizer, chemical, fuel
cow equipment, irrigation, feed supply, medication
equipment, irrigation, chemicals, agronomy, Coastal Farm
equipment, fertilizer
agronomy, equipment, chemicals, fertilizer, hardware
equipment, chemical, farm implement
machines, irrigation, chemicals, fuel, insurance
fertilizer, chemical, equipment, repairs
chemicals, fertilizers, farm supplies, agronomists
Ag West, agronomy, irrigation, equipment, parts, fertilizer and chemicals
fertilizers, Ag West, machinery parts, chemical, Knappa, Auto parts stores, irrigation
fertilizer, tractors, equipment, medications, vet supplies, irrigation
fertilizers, irrigation equipment, chemicals, seeds
equipment supply, building maintenance, hardware, vet supplies
chemicals, equipment, farm stores, implements
chemicals, equipment, farm stores, implements
fertilizer, chemicals, machinery parts, equipment, petroleum products, bee keepers, insurance
machinery repair, chemicals, fertilizers, fuel, feed, insurance, horticulturists
chemical, fertilizer, parts, hardware
chemicals, machinery repairs, medication, equipment
fuel, fertilizer, chemicals, hardware, safety equipment
chemicals, Ag West, parts, irrigation, tires
parts, equipment, fertilizer, seed

G3) *Do you know if any of the farmers surrounding your base of operations frequent the same stores?*

Number of "yes" responses: 29
Number of "no" responses: 1

G4) *Do you haul your goods to a processor?*

Number of "yes" responses: 18
Number of "no" responses: 12

G5) *If yes: Can you indicate to me on a map of Polk County the base locations of where the agricultural processors are that you employ?*

Responses

w/in 10 miles

w/in 10 mile

w/in 12 miles

Independence

Dallas

they do their own

Rickreall

Rickreall

Rickreall

Rickreall

Independence, Rickreall, McCoy

Independence, Rickreall, McCoy

w/in 10 miles

W. Salem

on the farm base

grass seed cleaners in Albany and Suver

Can you indicate to me on a map of Oregon the base locations of where the agricultural processors are that you employ?

Responses

Portland

Salem

Portland

Colorado

McMinnville

Portland, Benton County

McMinnville

Portland
Jefferson
Salem, WA, Canada
Albany, Tangent
Amity
Albany and Marion County
all over the state
Linn County w/in 30 miles
WA, Creswell
Portland, Corvallis
Portland, Corvallis
Medford
St. Paul, Portland

G6) *In no, do you use local handlers to ship your goods?*

Number of "yes" responses: 17
Number of "no" responses: 11
Number of "n/a" responses: 2

G7) *If yes: Can you indicate to me on a map of Polk County the base locations of where the agricultural shippers and handlers are that you employ?*

Responses

Dallas
Rickreall
Independence
Dallas, Perrydale
Rickreall, Independence, Dallas
Dallas
Dallas
w/in 3/4s of a mile
Rickreall
w/in 5 miles

Can you indicate to me on a map of Oregon the base locations of where the agricultural shippers and handlers are that you employ?

Responses

WA, Arkansas, Linn and Marion County: all w/in 50 miles
McMinnville
WA
Linn County and w/in 30 miles

Albany

G8) Do you store your crops at other farmers facilities?

Number of “yes” responses: 19
Number of “no” responses: 5
Number of “n/a” responses: 6

G9) If yes, what do you feel are the advantages and disadvantages centered around storing your crops on another farmers property?

Responses

concerns about maintenance and people breaking into the facilities

pro: safety protection, bartering with other farmers for good deals

advantage: a place to put it negative: fire damage, theft

con: safety and health issues

pro: when you don't have enough money to do it yourself, then it is a good option

pro: it pushes environmental concerns related to storage onto the other farmer
pro: don't have to deal w/ storage concerns--there is no need for original grower to have to handle product if it is stored elsewhere.

pro: don't have to handle product again

con: no direct control pro: farms are more trustworthy than commercial outfits

pro: you are not restricted by hours when you know the farmer personally

pro: ease and accessibility
pro: you have more control because your fellow farmer is looking out for your best interests, not just looking to make a buck off of you.

pro: farm facilities are closer w/ better economics and it is cheaper

con: fire and weather risk potential pro: more control over your product
Pro: there are costs associated with buildings that they don't have to deal w/ if they store their crop elsewhere.
Pro: he feels they can trust other farmers Con: when it is not on your own place you have to deal with other people

less expensive, often the storage unit is fairly close to your base of operations
pro: farmer isn't forced to put up another building himself--it is closer to his production site at another farm than it is at a local commercial storage outfit—he doesn't have to just let it sit out in the field and rot
pro: can store at closed buildings which keep out pests Con: your crop is at someone else's mercy

G10) Can you indicate to me on a map of Polk County the locations of where you store your crops other than on your own farm?

Responses

next door

w/in 3 miles

all w/in 5 miles

w/in 25 miles

w/in 9 miles

w/in 10 miles

all over Polk County

Bethel

w/in 2 miles

Rickreall

Perrydale

Rickreall

w/in 10 miles

Mc Coy, Rickreall, Independence

McCoy, Rickreall, Independence

w/in 4 miles

w/in a mile

w/in 5 miles

Can you indicate to me on a map of Oregon the locations of where you store your crops other than on your own farm?

Reponses

Shedd, N. Plains

w/in 20 miles

Linn County w/in 30 miles

Amity

St. Paul, Salem

A.2 Functional Specification of Dynamic Simulation Model

Population Module

Population(t) = population(t – dt) * (population growth) * dt

Population Growth = population growth rate * population

Population Growth Rate = 0.022

Initial Population = 35023

Land Use Decision

Population Accumulation(t) = Population Accumulation(t - dt) + (Growth – New Population) * dt

Initial Population Accumulation = 0

COOK TIME = 1

CAPACITY = 100000

FILL TIME = 19

Growth = Population Growth

New Population = CONTENTS OF OVEN AFTER COOK TIME, ZERO OTHERWISE

Infrastructure Module

Input Suppliers(t) = input suppliers(t – dt) + (supplier entry and exit) * dt

Supplier Entry and Exit = graph(restricted agricultural land + developable agricultural land)

Initial Input Suppliers = 247

Output Processors = output processors(t – dt) + (processor entry and exit) * dt

Processor Entry and Exit = graph(restricted agricultural land + developable agricultural land)

Initial Output Processors = 270

Agriculture Module

Ag Sales(t) = Ag Sales(t - dt) + (Change in Sales) * dt

Change in Sales = Sales Constant

Initial Ag Sales = 101417

Ag Expenses(t) = Ag Expenses(t - dt) + (Change in Exp) * dt

Change in Exp = Expense Constant + Conversion to Developed * Neighbor Interaction Factor + Output Processors * Output Processor Factor + Input Suppliers * Input Supplier Factor

Neighbor Interaction Factor = 0.015

Output Processor Factor = 0

Input Supplier Factor = 0

Initial Ag Expenses = 87751

Land Module

Restricted Agricultural Land(t) = Restricted Agricultural Land(t - dt) + (Increases in UGB) * dt

Increases in UGB = New Population*Land Needs Factor

Land Needs Factor = 0.31

Initial Restricted Agricultural Land = 185000

Developable Agricultural Land(t) = Developable Agricultural Land(t - dt) + (Increases in UGB – Conversion to Developed) * dt

Increases in UGB = New Population*Land Needs Factor

Conversion to Developed = GRAPH(Agricultural ROI/Alternative ROI)

Agricultural ROI = AG Profits / ((Restricted Agricultural Land + Developable Agricultural Land) * (Market Value of Ag Land))

Ag Profits = Ag Sales – Ag Expenses

Market Value of Ag Land = 3

Alternative ROI = .04

Initial Developable Agricultural Land = 1440

Developed Land(t) = Developed Land(t - dt) + (Conversion to Developed) * dt

Initial Developed Land = 29295