Agricultural Land Use

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Introduction

Agriculture is an integral part of the Willamette Valley, covering over one million acres, including much of the state's best agricultural land, and providing a diverse array of commodities for both domestic and international markets. Agricultural lands also provide important areas of open space and wildlife habitat, while the proximity of farmland to natural areas challenges growers to use management techniques that reduce the negative impacts of farming on sensitive areas. These factors suggest that any significant changes in the agricultural system would be felt throughout the valley economy and ecosystem. Yet despite agriculture's importance, the only comprehensive description of agricultural production and practices is in the form of county-level statistics. While these statistics are helpful, they cannot be used to infer the future impact of various policy options on different aspects of the agricultural system. To achieve this, a land and crop allocation model was developed that simulates yearly changes in the basin's farmland from 1990 to 2050. The three future landscapes generated from this model provide a means of studying the effect of different management alternatives on the agronomic, economic, and environmental components of the agricultural system.

Methods and Information Sources

Agricultural practices affect the surrounding environment, while societal choices influence decisions about agricultural production and land management. To understand the implications of this interaction requires knowledge of where agricultural production takes place and how decisions concerning that production are made. In this model, spatial data were manipulated within a geographic information system, while a multiple-attribute decision-making methodology was used to represent the crop-selection decisions made by agricultural producers. The attributes that went into these decisions included the availability of suitable land, sufficient water, and a crop's expected cost and return. The resulting model is thus able to combine economic and biophysical information with decision-making processes. Future landscapes are then generated through the evaluation of each field's condition in the agricultural landscape. When a field requires a new crop, the model makes a crop decision, subject to the assumptions and constraints of the future scenario.

Assumptions

Both the crop allocation model and each particular future scenario have associated with them a set of assumptions. The following set of model assumptions is applied to each of the scenarios:

- Growers make rational decisions about crop selection based on a number of biophysical and management attributes.
- A field must be at least five acres in area to be considered a viable agricultural production site.
- No provision is made for animal operations.
- All cropping systems' selections must be made from the following list:

Irrigated perennial	Woodlot	Orchard
Irrigated berry/vineyard	Christmas trees	Grain
Irrigated nursery crop	Hybrid Poplar	Hay
Irrigated annual rotation	Grass seed rotation	Pasture

- Each cropping system has a specific set of crop rotation and growth parameters.
- A field must have a water right in order to grow irrigated crops. The amount of water that can be withdrawn is limited by the individual permit and, for surface-water rights, the availability of water in the associated water availability basin (pp. 114-16).

The assumptions listed above were employed in the creation of the circa 1990 distribution of agricultural land. Using this initial distribution as a starting point, three future agricultural landscapes were generated. Plan Trend 2050 enforces yearly changes in crop production levels throughout the 60-year simulation period. These production levels are based on historical trends,[117] but have been modified where necessary to account for current situations that appear to be altering long-term trends. Such situations include: a reduction in vegetable production caused by the closure of some area food processors accompanied by increased production levels in other regions; and increasing adoption of relatively new crops such as hybrid poplar. Development 2050 scenario assumptions augment the Plan Trend 2050 assumptions with provisions for field fragmentation and conversion due to development incursions. Conservation 2050 includes additional fragmentation and conversion effects due to the establishment of Tier 1 conservation reserves and the inclusion of habitat quality as a decision factor in crop selection for Tier 2 agricultural fields (p. 90). In addition, it was hypothesized that future advancements in the fields of irrigation technology and crop genetics would accommodate a 10% reduction in irrigation requirements with no adverse impact on crop production levels. These water savings were implemented and the water made available for in-stream uses. There are no assumptions for Pre-Settlement conditions, as commercial agricultural production developed after settlers migrated to the region in the mid-1800s.

Results

Results focus on three areas: land conversion, crop selection, and wildlife habitat. Land conversion is detrimental to the agricultural system because it reduces the quantity of farmland available for production. It is most detrimental when the farmland lost is of high quality, as both production levels and crop diversity suffer. Together, Table 33 and Figure 110 describe the nature and distribution of this conversion for both prime [118] and other agricultural land. Land conversion in Plan Trend 2050 is minimal; however, both Development 2050 and Conservation 2050 have a notable reduction in agricultural acreage. The largest reduction occurs in Development 2050, with one-third of the conversion due to built structures and the remainder in remnant, unusable, agricultural land. The amount of converted land is somewhat less in Conservation 2050, with nearly all land conversion due to restoration activities. The amount of prime farmland converted is greatest in Development 2050, with two-thirds of the converted lands occurring on prime farmland, while roughly half of the land used for restoration activities in Conservation 2050 is of this type.

Land Use		LULC 1990	Conservation 2050	Plan Trend 2050	Development 2050
All Farmland	Agricultural	100%	83%	99%	80%
	Built	0%	1%	1%	6%
	Natural	0%	16%	0%	14%
Prime Farmland	Agricultural	100%	85%	99%	76%
	Built	0%	2%	1%	8%
	Natural	0%	13%	0%	17%

Table 33. *Distribution of 1990 agricultural land use for each scenario.*

The Willamette River Basin can be divided into three regions, shown in Figure 111. The distribution of crops within the active agricultural land for each region and the entire basin is shown in Figure 112, while the percent change relative to 1990 is listed to the right in Table 34. Both these descriptions are needed, as a large percent change in production levels may not be significant if only a small portion of land contains the crop — an example is the wood products class, which as a new crop had a limited distribution but steadily increasing acreage. These data sets indicate a general trend in the north and middle regions of the valley toward an increase in higher-valued grass seed production at the expense of grain and hay. There is also a reduction in irrigated food crops and an increase in specialty crops (Christmas trees and nursery crops). In the south, grain and hay remain stable while grass seed production declines and pasture increases. In all regions, fruit and nut crops remain stable, reflective of the long-term investment in the crop. It

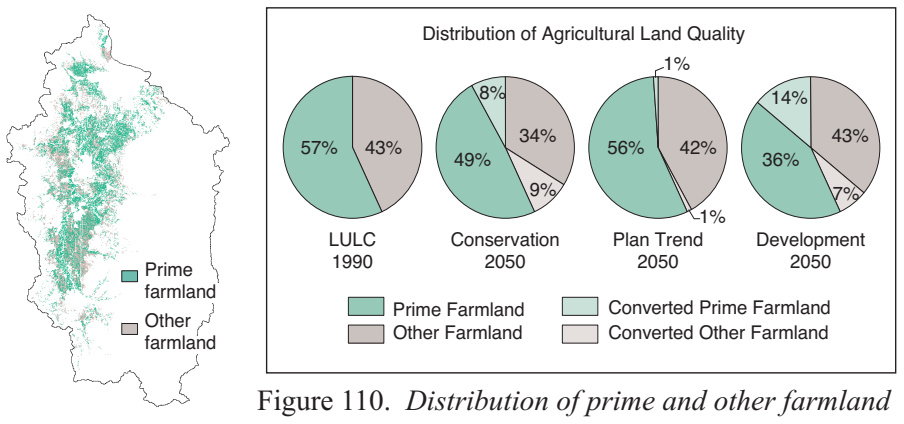

Figure 110. *Distribution of prime and other farmland for each of the alternative scenarios.*

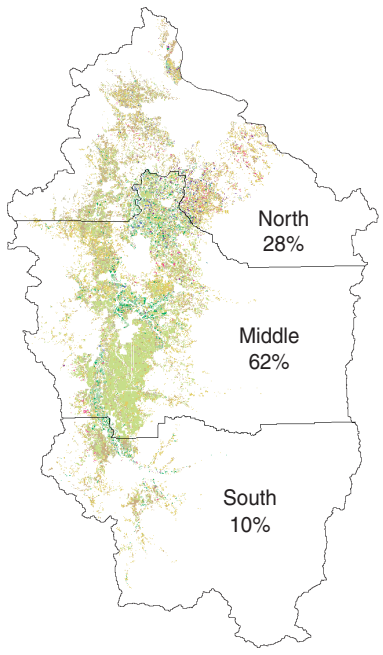

Figure 111. *Distribution of farmland over the three regions of the Willamette River Basin. The counties contained in each region are:*

North - *Clackamas, Columbia, Multnomah, Washington, Yamhill*

Middle - *Benton, Linn, Marion, Polk*

South - *Lane*

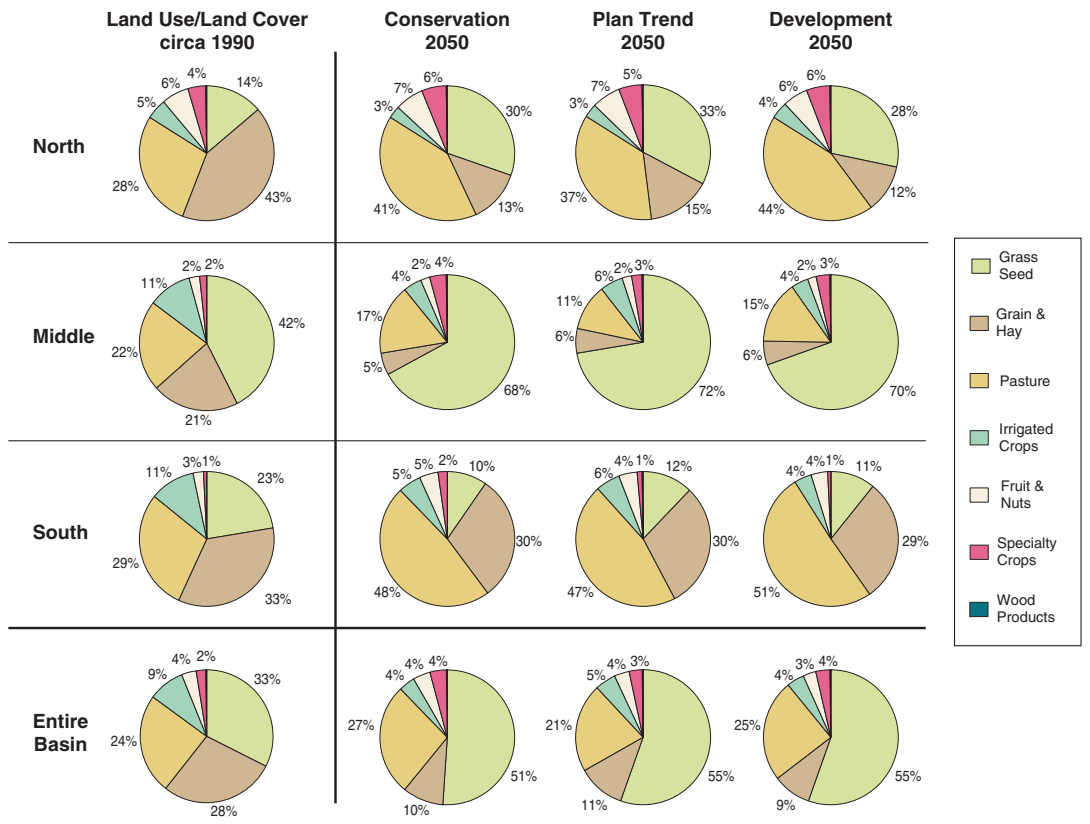

Figure 112. *Crop distribution for each region and the entire basin. In all cases the amount of wood products (wood lot and hybrid poplar classes) is less than 1% of the total agricultural acreage.*

is difficult to draw economic conclusions from these data, as crop prices and markets will be very different in 2050; however, we can get some idea of the economic implications of these changes by considering the 1997 gross sales per acre for various crops, shown at the bottom of Table 34. These values suggest that the reduction in grain, hay, and irrigated vegetable and field crops could be successfully mitigated by the increased returns afforded by grass seed and specialty crop production. However, this consolidation of agricultural production into fewer crop classes may reduce the resiliency of the agricultural system, making it more susceptible to external forces (e.g., pest infestations, economic downturns).

Region	Scenario	Grass Seed	Pasture	Grain & Hay	Fruit & Nuts	Irrigated Crops	Specialty Crops	Wood Products
North	Conservation	116%	45%	-69%	7%	-39%	36%	34%
	Plan Trend	135%	27%	-64%	8%	-33%	25%	68%
	Development	103%	57%	-72%	-6%	-18%	28%	49%
Middle	Conservation	58%	-23%	-75%	5%	-59%	128%	116%
	Plan Trend	70%	-49%	-70%	-8%	-48%	54%	119%
	Development	64%	-31%	-73%	-12%	-62%	104%	84%
South	Conservation	-57%	63%	-12%	80%	-49%	159%	43%
	Plan Trend	-46%	57%	-12%	65%	-43%	64%	99%
	Development	-52%	73%	-14%	46%	-60%	12%	2%
Entire Basin	Conservation	29%	-71%	-10%	-9%	-63%	49%	48%
	Plan Trend	68%	-61%	-13%	4%	-46%	37%	95%
	Development	35%	-75%	-20%	-30%	-64%	24%	30%
Gross Sales/Acre		$700[119]	na	$230[119]	$2,430[119]	$1,500[119]	$7,000[120]	na

Table 34. *Percentage change in crop acreage relative to available farmland for each future scenario, with respect to 1990 farmland. Also shown are the 1997 gross sales per acre for each cropping system, where available.*

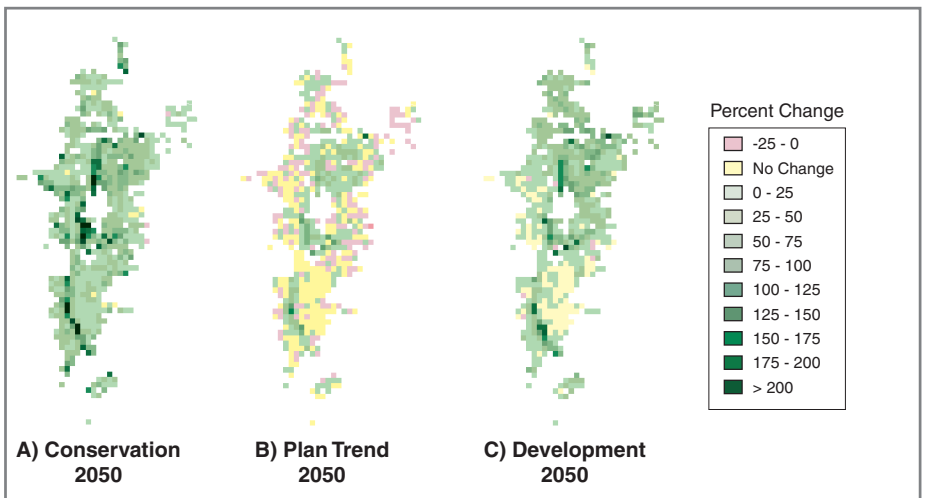

Figure 113. *Percentage change in the number of wildlife species for which farmland represents suitable habitat for each future scenario, relative to 1990 values.*

An important assumption of Conservation 2050 was the restoration of native vegetation, much of which takes place on agricultural lands. Did these efforts result in an improvement in species habitat? An analysis of the suitability of agricultural lands to support native wildlife, using the wildlife habitat assessments described on pages 124-27, is shown in Figure 113. A comparison of these results with 1990 land use shows that Plan Trend 2050 does not differ appreciably from 1990 conditions. However, both Conservation 2050 and Development 2050 do show an improvement relative to 1990 conditions. In both cases the number of species, on average, increased, with the greatest increase occurring in Conservation 2050. Figure 113a shows an increase in the number of native species along the Willamette River riparian corridor. There is also improvement throughout the valley, due to the increased use of field borders, riparian vegetation, and small areas of restored prairie grass. Development 2050, shown in Figure 113c, exhibits fewer contiguous areas of improvement and more land undergoing little or no change. Where species richness does increase in Development 2050, it is largely as a result of yards, gardens, and hobby farms placed on former agricultural lands. The fragmented nature of this habitat and its proximity to human communities may reduce its overall attractiveness for many wildlife species.

Summary

The three sets of future scenario assumptions produced qualitatively different landscapes. In Plan Trend 2050 almost all of the 1990 agricultural lands remained in agricultural production. Development 2050 allowed greater development in rural areas, leading to fragmentation and conversion of agricultural fields; while Conservation 2050 encouraged the establishment of field borders, the selection of low-input crops in sensitive areas, and the conversion of cropland to native vegetation. The major agricultural results from the alternative futures analysis are:

- In each future, the distribution of crops within the existing agricultural land was similar. This suggests that the Willamette Valley would continue to support a variety of crops under any of the scenarios, though the number of crop choices may be reduced.
- In Plan Trend 2050 the continuation of current policies regulating the expansion of urban growth boundaries had little impact on agricultural acreage. In contrast, the implementation of vegetation restoration activities in Conservation 2050 and the increased use of rural lands for residential development taking place in Development 2050 resulted in a manifest reduction of agricultural acreage. Areas of development showed a preference for prime farmland, while restoration activities tended to select more farmland of lower quality.
- Incorporation of conservation practices in Conservation 2050 enhanced wildlife habitat without significantly altering the function of the agricultural system. Development 2050 also showed some local improvement in wildlife habitat due to increases in natural vegetation associated with the built environment. Plan Trend 2050 showed little change in habitat quality as few modifications were made to agricultural lands.