

# Farmland protection in Washington State: An analysis

Gary R. Christensen, William W. Budd, John P. Reganold, and Frederick R. Steiner

**ABSTRACT:** A survey of all county planning departments in Washington State indicated that protecting agricultural land is a major concern at the county level. Maintenance of the agribusiness sector is the main reason for protecting agricultural land, while the preservation of open space and rural lifestyles was of secondary importance. As a result, most Washington counties have implemented a broad range of farmland protection strategies. However, county governments generally have found these measures only moderately effective in keeping farmland from being converted to nonagricultural uses. As a result, there is support for an integrated, statewide program that includes farmland protection measures.

**W**HILE conflicts over land use have been debated for years, one of the most controversial issues to emerge during the 1970s was the conversion of agricultural land to urban or built-up uses. Debate has centered on the rates of agricultural land conversion and whether or not these conversions are a significant environmental problem. Meanwhile, public concern about farmland conversion and the loss of open space has resulted in new government policies at the local, state, and federal levels.

Agricultural land protection has been adopted as a public policy goal for state, provincial, and local governments in the Pacific Northwest. Washington State does not have a statewide planning program. But its neighbors—Oregon, Idaho, and British Columbia—have adopted mandatory, statewide or provincewide land use laws to protect agricultural and resource lands. Farmland protection is one of the primary objectives of statewide planning programs in Oregon (9, 14), Idaho (10), and British Columbia (4).

In 1975, the Washington State House of Representatives approved a statewide land use planning bill, but the bill was defeated in the Senate. A decade later, statewide land use planning was still being debated in the legislature (1). State Senators Talmadge and Williams have introduced a bill now under

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consideration “to deal with land use on a statewide policy basis by initially focusing on the prevention of urban sprawl and preservation of agricultural lands, forest lands, and mineral resource lands” (23).

Agricultural land losses have been significant in Washington State, especially in western areas. Two independent sources report state agricultural land losses of 23,800 acres/year between 1970 and 1980 (15) and 26,800 acres/year between 1967 and 1982 (19, 20). Washington’s metropolitan counties are most challenged with retaining productive farmland as their communities expand into the surrounding, fertile agricultural valleys. For example, Northwest Economic Associates estimated that the Puget Sound area in western Washington may lose between 20% and 27% of its agricultural land to nonagricultural uses between 1980 and 2000 (17).

While prime farmland has been converted at a rapid rate in the metropolitan Puget Sound area, land of less intrinsic value

for agriculture has been brought into production in the arid Columbia Basin region—about 521,459 acres of irrigated cropland and pasture—in central Washington at very high public and private costs (25). Aside from the conversion issue, there are many other social, economic, political, and environmental reasons why prime farmland should be retained in agricultural use (18).

County governments in Washington have adopted and implemented several growth management strategies to reduce the rate of farmland conversion to nonagricultural uses (3, 7, 24). For example, the farm-disparate counties of Clark, Skagit, Whitman, and Yakima (Figure 1) have enacted farmland protection programs through agricultural zoning (3). King County has adopted an ambitious and innovative program to protect farmland through the purchase of development rights (13). Klickitat County has developed a unique approach to regulating development in forest, farm, and range areas by adopting a combination of zoning and performance standards (2). In Island County, a transfer of development rights program has been adopted to stimulate open space protection and to retain forest and agricultural lands.

To investigate farmland protection efforts and concerns at the county level in Washington State, we conducted a survey of all 39 county planning departments. Herein, we analyze the concerns, issues, and problems concerning farmland protection as viewed by Washington county planners, as well as the various programs that have been adopted. We then examine the effectiveness of these programs based on the survey re-

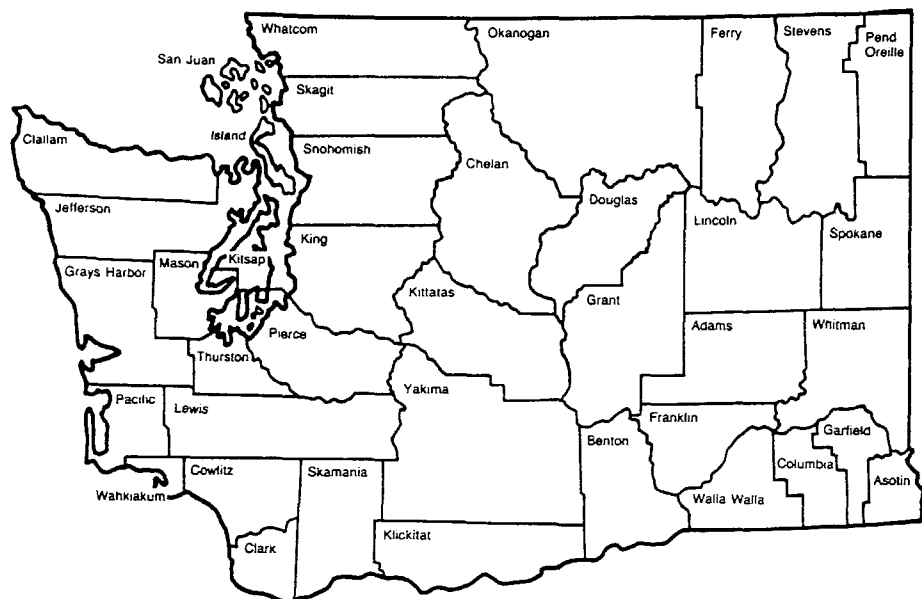


Figure 1. Counties of Washington State.

sponses. This analysis provides direction for possible new county and state efforts, both in Washington State and elsewhere.

### Study methods

We mailed a questionnaire to the planning departments of Washington's 39 counties to determine how agricultural land protection was viewed locally and to find out what, if any, programs had been adopted to retain productive farmland. Survey design followed that described by Dillman (11). The purposes of the survey were to document systematically statewide agricultural land protection issues, planning methods, and program effectiveness with regard to reducing the conversion of agricultural lands to nonagricultural uses and to analyze, interpret, and draw general conclusions about agricultural land protection in Washington.

Questionnaires were mailed in October 1985. We received responses from all of the counties; however, every question was not

**Table 1. Most important reasons for protecting agricultural land.**

Answers	Number of Responses	
	Percent	Percent
Maintaining agribusiness sector	23	69
Maintaining local food supplies	1	3
Preserving open space	3	9
Preserving rural lifestyles	3	9
Soil conservation	2	6
No response	1	3

always answered by the county planners. The opinions and responses from the statewide survey are the views of planning representatives of the counties. We assumed that, as a representative of the county planning department, the data reflect the viewpoint of the county planning departments.

### Results and discussion

*Concerns, issues, and problems.* Between 1970 and 1980, Washington's population in-

creased 21%—from about 3.4 million to slightly more than 4.1 million people (5). During the 1970s, metropolitan areas grew 20% while nonmetropolitan areas grew 22%. Although this may not appear as a difference, during the 1960s metropolitan areas grew by 19% and nonmetropolitan areas grew by .01%.<sup>1</sup>

In the metropolitan areas of Washington, county planners reported that they experienced either moderate or high development pressures to convert agricultural land to urban or built-up uses during the past decade. The metropolitan areas accounted for 25% (4.2 million acres) of Washington's agricultural land base (16.5 million acres) (6). In addition, the 11 counties defined as metropolitan areas accounted for 47% of Washington's \$1.1 billion farm net income in 1982.<sup>2</sup> County planners reported that another 15 nonmetropolitan counties received either moderate or high development pressures to convert farmland to nonagricultural uses during the past decade.

Because a significant amount of agricultural land is perceived to be threatened and the relative value of that agricultural land is high, a majority of Washington county planning departments (84%) expressed concern about protecting agricultural land. Of the 26 counties that reported moderate or high urban development pressures during the past decade, all but 2 indicated concern about retaining farmland for agricultural production.

In addition to concerns about the conversion of agricultural land to nonagricultural uses, particularly irreversible uses, county planners reported several reasons why protecting farmland was important. The primary reason for protecting agricultural land was to maintain the agribusiness sector of the local economy (Table 1). Twenty-seven counties (71%) indicated that agriculture is important to their local economies. Sixteen county planning departments reported that agriculture was the most important sector of their economy.

Of the 27 counties reporting that agriculture was important to their local economies, 15 (56%) indicated that during the past decade they experienced moderate or high development pressures to convert agricultural land to urban or built-up uses.

<sup>1</sup>Cook, A. K. (no date). "Demographic and Agricultural Trends in Washington." Paper presented at the Future Spokane Leadership Forum on Megatrends in Business and Agriculture in Spokane, Washington.

<sup>2</sup>Bureau of Economic Analysis. 1982. U.S. Department of Commerce. Unpublished farm income computer tapes compiled by Gary Smith, Cooperative Extension, Washington State University, Pullman.

**Table 2. Washington State net farm income as a percentage of total county net industry income and county share of Washington State net farm income, 1987.**

County	Net Farm Income as a Percentage of Total County Net Industry Income		County Share of Washington Farm Net Income		
	Percent of Share	County Rank	Farm Income (\$1,000)	Percent of Share	County Rank
Adams	37.57	4	41,194	3.62	12
Asotin	9.26	20	4,082	0.36	33
Benton	3.57	25	43,592	3.83	9
Chelan	13.08	13	50,996	4.49	5
Clallam	2.11	30	5,656	0.39	30
Clark	2.15	29	22,173	1.95	19
Columbia	44.49	3	17,094	1.50	22
Cowlitz	1.48	36	9,099	0.80	27
Douglas	27.92	6	25,035	2.20	17
Ferry	31.65	5	9,079	0.80	28
Franklin	12.74	14	31,531	2.77	15
Garfield	51.26	2	11,773	1.04	26
Grant	25.39	8	76,757	6.75	2
Grays Harbor	2.66	27	15,682	1.38	23
Island	1.86	33	4,422	0.39	31
Jefferson	2.03	31	1,635	0.14	36
King	0.28	38	42,831	3.77	10
Kitsap	0.11	39	1,225	0.11	38
Kittitas	9.38	19	11,997	1.06	24
Klickitat	11.48	15	12,087	1.06	25
Lewis	6.32	23	22,468	1.98	18
Lincoln	57.57	1	46,792	4.12	8
Mason	1.68	34	2,320	0.20	35
Okanogan	21.02	9	41,973	3.69	11
Pacific	6.44	22	6,571	0.58	29
Pend Oreille	9.45	18	2,604	0.23	34
Pierce	0.88	37	28,444	2.50	16
San Juan	4.73	24	1,521	0.13	37
Skagit	10.63	17	47,062	4.14	6
Skamania	2.70	26	1,060	0.09	39
Snohomish	1.67	35	35,887	3.16	14
Spokane	1.98	32	47,070	4.14	7
Stevens	14.71	12	21,917	1.93	20
Thurston	2.62	28	20,656	1.82	21
Wahkiakum	18.56	11	4,355	0.38	32
Walla Walla	10.85	16	39,047	3.43	13
Whatcom	8.13	21	57,570	5.06	4
Whitman	25.60	7	63,315	5.57	3
Yakima	19.09	10	208,180	18.31	1
Washington	3.30	39	1,136,752	100.00	39
United States	1.83				

Source: Bureau of Economic Analysis unpublished data compiled by Gary Smith, Washington State University, Pullman.

These 15 counties represented about 60% of Washington's \$1.1 billion net farm revenue for 1982.

The Bureau of Economic Analysis has determined the "county share of Washington's total farm net income" (Table 2). In 1982, Yakima County held the largest county share of the state's farm net income (18%). All other county shares were below 7%. A majority of counties surveyed indicated that agriculture was important to their local economy. Eleven county planning departments, all in the western part of the state, reported that agriculture was not important to their local economy. Those 11 counties represented a total net farm income of more than \$158 million or slightly less than 14% of Washington's 1982 agricultural net revenue. Eight of the 11 county planning departments indicating that agriculture was not important to their local economy still view farmland protection as an important concern. Reasons given for retaining agricultural land were to preserve open spaces and rural lifestyles and to protect agribusiness.

**Farmland protection strategies.** Faced with increasing agricultural land conversion to urban or built-up uses, the issue of farmland protection has become an important priority for many Washington county planning departments. Generally, agricultural land protection strategies are implemented to reduce the relative attractiveness of agricultural areas for development, to offset additional burdens on agricultural landowners caused by urbanization, and to implement measures that prevent changes in land use from agricultural uses to nonagricultural uses (8).

Our survey revealed that agricultural land protection strategies have been implemented in 32 (82%) of the counties. Of the seven counties that have not adopted protection programs, Garfield, Jefferson, Lewis, and Pend Oreille Counties are not currently pursuing any such policies, while Mason, Thurston, and Wahkiakum are (Figure 1). These seven counties have relatively small agricultural sectors representing 650,963 acres of farmland or 4% of the state total (6). In addition, the seven counties contributed less than 6% to the total farm net income of the state.

Twenty different kinds of agricultural land protection strategies have been adopted by 32 of Washington's 39 counties. Table 3 lists 10 of the more common programs. A majority of these counties have adopted some type of regulatory mechanism. Under Washington State law, counties are not required to develop comprehensive plans. However, comprehensive plans with goals for agricultural land are the most popular practice used by 30 of 32 (94%) county governments. Twenty-four (80%) of the 30

**Table 3. Implemented agricultural land protection strategies in Washington State.**

Strategy	Counties with Strategy
Comprehensive planning	30
Large lot zoning	20
Agricultural exclusive zoning	9
Agricultural nonexclusive zoning	14
Purchase of development rights	1
Purchase and resale/lease with restrictions	1
Transfer of development rights	2
Promotion of open space taxation	21
Development permit system	12
Right to farm ordinance	2
Other	10

counties with farmland protection goals in comprehensive plans enforce these goals with some kind of zoning regulation (large-lot, agricultural exclusive, agricultural non-exclusive, and resource lands). Twelve counties use a development permit system and two counties (Island and Yakima) have adopted right-to-farm ordinances.

The most popular financial compensation mechanism used by counties is to encourage participation in the state open space taxation program. Farmland (and other open space) is assessed at its current use value rather than at its market—highest and best use—value (22). Twenty-one (66%) of 32 counties with policies for farmland retention promote open space taxation on agricultural and resource lands. Other financial compensation mechanisms used by county planning departments are the purchase of development rights in King County, the purchase and resale or lease with restrictions in King County, and the transfer of development rights in Clallam and Island Counties (Table 3).

Although a majority of Washington's counties use regulatory mechanisms to protect agricultural land, most of the planning departments reported that these regulations are combined with financial programs. Of the 32 counties with farmland protection strategies, 20 (63%) have adopted comprehensive mechanisms, 11 (34%) use only regulatory mechanisms, and one county (Pierce) exclusively uses financial mechanisms (open space taxation).

**Effectiveness of farmland protection.** A number of factors can be used to assess the effectiveness of county agricultural land protection efforts in Washington. Deterring unwanted land use change, political acceptability, and the longevity of farmland protection programs can be evaluated to determine if efforts have been successful or unsuccessful. However, problems arise when a policy is judged effective using one criterion but ineffective using another (16).

There are limitations to determining how successful programs are at the county level in Washington. A complete examination would include an analysis of land use changes to determine how much agricultural land has been converted over the years to nonagricultural uses. Determining how much farmland currently exists (or existed) in a county is problematic. Previous studies have revealed different amounts of land in agricultural use, and farmland conversion rates are either unavailable or unreliable at the county level. In addition to determining the number of acres converted to urban uses, it is also important to document qualitative changes, for example, the value of soil and water resources, to properly assess conversion impacts. Unfortunately, even less is known about the quality of land use change than is known about the quantity (12).

Many Washington county programs are relatively new. Therefore, it may be some time before a thorough examination can be made to determine if a county's protection efforts have been effective or ineffective in retaining land for agricultural uses.

With little data about land use changes over time, we relied on the survey responses for some indication of farmland protection effectiveness. We asked planning department officials to rate (high, moderate, low, or no) the "overall effectiveness of their county's mix of agricultural land protection strategies." While this is a relative test, it does provide insight into county farmland protection success as perceived by local planners.

According to county planners, 67% of the counties experienced "overall moderate success with their agricultural land protection strategies in keeping farmlands from being converted to urban nonagricultural uses." Five counties indicated that they were highly effective and five responded that they had low to no effectiveness.

Grant, Grays Harbor, Lincoln, and Pacific Counties reported high effectiveness with regulatory strategies. All four counties have comprehensive plans with goals for protecting farmland. Three of the four (except Lincoln) use some type of zoning regulations on agricultural land. King County also reported high success; it used seven different types of strategies to protect agricultural land. King County has implemented both financial and regulatory mechanisms. Of the 25 counties that have had moderate or high success with farmland protection strategies, 16 have used comprehensive programs and 9 have adopted only regulatory mechanisms.

Our survey indicated that farmland located within the urban fringe of cities and towns has come under the greatest develop-

ment pressures for residential, commercial, manufacturing/industry, and other urban uses. According to county planners, residential development is largely responsible for farmland conversion to urban uses. In addition to conversion pressures in urban fringe areas, county population growth and annexation activity by cities have created impacts on farmland near highways, water bodies, rural land, and in other areas.

Between 1970 and 1980, eight counties (Benton, Clark, Ferry, Island, Jefferson, San Juan, Stevens, and Thurston) have had population increases of 50% or more (5). County planners in Clark, Island, and San Juan Counties reported moderate success in protecting farmland. In Ferry and Stevens Counties, planners rated agricultural land protection success low. Farmland protection strategies have not been implemented in Jefferson and Thurston Counties. Benton County planners did not rate the effectiveness of their protection efforts.

Eight counties (Benton, Grays Harbor, King, Kitsap, Pierce, Snohomish, Whatcom, and Yakima) had more than 5 square miles (3,200 acres) of land annexed by cities between 1970 and 1980. Although annexed land does not necessarily mean agricultural land, surrounding farmland is often under urban development pressures as cities expand and grow. All eight counties reported moderate or high development pressures during the past decade. County planners reported high success with farmland protection programs in Grays Harbor and King Counties. Moderate success was reported in Snohomish, Whatcom, and Yakima Counties. Kitsap and Pierce Counties reported low or no success.

Although political support is not in itself an indicator of successful farmland protection policies, it is a logical prerequisite for program effectiveness. Generally, county planning departments reported that they have received support from farmers, non-farm rural residents, city residents, environmentalists, and local government officials. In contrast, land developers have generally opposed county efforts to protect agricultural land from urban development.

We asked county planners to identify the key advantages of their respective agricultural land protection strategies. Of the 26 counties that reported moderate or high success with farmland protection programs, 22 counties (85%) said they were politically acceptable, and 17 counties (65%) indicated that their programs were relatively inexpensive to implement. Less than one-half of the 26 counties with moderate or high success reported that their protection efforts involved a large participation of landowners, were able to deter unwanted land use

change, offered financial incentives for landowners, expected strategies to have longevity, or enjoyed broad support from citizens.

All counties but one that reported having agricultural land protection strategies identified potential problems or disadvantages. Problems most often mentioned were lack of enforcement mechanisms, density and lot-size specifications, weak programs from the standpoint of political support offering short-term solutions to long-term problems, impermanent strategies, and non-uniform zoning throughout the county.

How successful has farmland protection been in Washington? Without available or reliable quantitative and qualitative data on agricultural land losses at the county level in the state, it is difficult to make an objective analysis. Most of the county planners surveyed rated their protection efforts as moderately successful. Counties that have experienced population growth and increased annexation activity during the past decade generally have encountered problems in retaining farmland for agricultural uses. The survey results indicate that counties using a comprehensive approach (regulatory controls and financial incentives combined) generally had greater farmland protection success than counties that adopted only regulatory or financial mechanisms. County success in retaining agricultural land appears largely due to support from various interest groups, the political acceptability of strategies, and the implementation of relatively inexpensive programs.

**More farmland protection strategies and state involvement.** County planners generally indicated that they would like to strengthen farmland protection efforts by implementing additional measures. Planners in 54% of the counties would like to develop additional strategies. Seventeen of these 19 counties reportedly encountered difficulties when they attempted to develop new or additional farmland protection mechanisms.

A major obstacle to adopting new programs has been the political sensitivity of land use planning. Perhaps in an effort to overcome some of the political opposition to local farmland protection strategies, 60% of the county planners believed there should be a statewide program involving incentives and guidelines for agricultural land protection. Of the 23 counties that expressed an interest in a statewide program, 65% indicated that the program should be voluntary. While counties would generally support a statewide effort to protect farmland, planning department officials revealed that there is some opposition to state land use controls and would prefer to retain local administration of such a policy.

This suggests a need for a state initiative to deal with the concerns, issues, and problems that many counties are faced with in protecting farmland and adopting land use controls. By improving land use planning and regulatory laws, regional councils and local governments then would be able to better manage resource lands.

#### REFERENCES CITED

1. Ammons, David. 1985. *Statewide land-use planning comes up again*. The Olympian (Feb. 26): 2A.
2. Anderson, Steven B. 1984. *Resource land management in Klickitat County*. Northwest Land Use Rev. (Feb./Mar.): 16-18.
3. Brandt, Theodore R. 1982. *Agricultural land retention in the Puget Sound region, Washington*. M.S. thesis. Dept. Geog. and Reg. Planning, W. Wash. Univ., Bellingham. 157 pp.
4. Bray, C. E. 1984. *Canadian provincial farmland protection programs*. In Frederick R. Steiner and John E. Theilacker [eds.] *Protecting Farmlands*. AVI Pub. Co., Westport, Conn. pp. 243-261.
5. Bureau of the Census. 1980. *Characteristics of the population: Number of inhabitants, Washington*. U.S. Dept. of Comm., Washington, D.C.
6. Bureau of the Census. 1982. *Census of agriculture, Washington State and county data*. U.S. Dept. Comm., Washington, D.C.
7. Coughlin, Robert E., John D. Esseks, and William Toner. 1981. *An inventory of state and local programs to protect farmlands*. Nat. Agr. Lands Study, Washington, D.C.
8. Coughlin, Robert E., John C. Keene, J. Dixon Esseks, William Toner, and Lisa Rosenberger. 1981. *The protection of farmland: A reference guidebook for state and local governments*. Nat. Agr. Lands Study, Washington, D.C. 284 pp.
9. Degrove, John M. 1984. *Land growth and politics*. APA Planners Press, Chicago, Ill. 454 pp.
10. de Reus, Judy. 1979. *Agricultural land in Idaho: How it can be defined, classified, and protected*. Idaho Bur. Econ. Resources and Community Affairs, Boise.
11. Dillman, Don A. 1978. *Mail and telephone surveys: The total design method*. Wiley, New York, N.Y. 325 pp.
12. Dunford, Richard W. 1983. *An overview of the farmland retention issue*. Congr. Res. Serv., Libr. Congr., Washington, D.C. 76 pp.
13. Duvernoy, Gene. 1986. *Preserving King County's farmland*. Northwest Land Use Rev. 11(4): 6-10.
14. Eber, Ronald. 1985. *Oregon's agricultural land protection program*. In Frederick R. Steiner and John E. Theilacker [eds.] *Protecting Farmlands*. AVI Pub. Co., Westport, Conn. pp. 161-171.
15. Frey, H. Thomas. 1983. *Expansion of urban area in the United States: 1960-1980*. Tech. Rpt. No. AGE5830615. Econ. Res. Serv., U.S. Dept. Agr., Washington, D.C. 16 pp.
16. Furuseth, Owen J., and John T. Pierce. 1982. *Agricultural land in and urban society*. Assoc. Am. Geog., Washington, D.C. 89 pp.
17. Northwest Economic Associates. 1979. *Report no. 13 of the Northwest Agricultural Development Project*. Vancouver, Wash. 210 pp.
18. Reganold, John P. 1986. *Prime agricultural land protection: The Washington State experience*. J. Soil and Water Cons. 41(2): 89-92.
19. Soil Conservation Service. 1971. *Basic statistics—national inventory of soil and water conservation needs, 1967*. U.S. Dept. Agr., Washington, D.C.
20. Soil Conservation Service. 1984. *1982 national resources inventory preliminary report*. U.S. Dept. Agr., Washington, D.C.
21. State of Idaho. 1980. *Idaho Code, Chapter*

65. The Bobbs-Merrill Co., Indianapolis, Ind.
22. State of Washington, 1985. *Revised Code of Washington Annotated, Title 84. Chapter 84.34*. West Pub. Co., St. Paul, Minn.
23. State of Washington, Senate. 1985. *An act relating to land use planning*. 49th Leg., Regular Session, Senate Bill No. 3492. Olympia.
24. Weinan, Richard. 1984. *Land use in Washington: A survey of county programs*. Northwest Land Use Rev. (Feb.-Mar.): 7-13.
25. Whittlesy, N. K., J. R. Buteau, W. R. Butcher, and D. Walker. 1981. *Energy tradeoffs and economic feasibility of irrigation development in the Pacific Northwest*. Col. Agr. and Home Econ., Wash. State Univ., Pullman. □

# Criteria for delineation of agronomic zones in the Pacific Northwest

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**ABSTRACT:** A system for extending conservation tillage research and management practices in the Pacific Northwest has been developed using climatic, soil, and biological parameters to delineate agronomic zones. These zones provide an easily developed, logical foundation for transferring and interrelating management and research information among separate but similar farming areas. Parameters for zone delineation are annual precipitation, growing degree days from January 1 to May 31, and soil depth. Different categories of each parameter combine to best resolve the different zones that exist in north central Oregon. Management practices and problems within each zone are sufficiently common that soil conservationists could adjust technical guides and erosion control systems specific to each individual agronomic zone. Crop or erosion simulation models should be applicable within zone boundaries.

**S**PEAKERS at conservation tillage meetings often describe their farms or fields as located in an area of shallow or deep soils with a specified amount of annual precipitation. They may also specify the crop grown, crop rotation, or tillage system used. As evident from comments from audiences, many people are confused about whether a specified management system will apply in their own local area.

Agriculture Handbook 296 (7) now contains the only available land classification system for the Pacific Northwest. Delineating the United States into major land resource areas (MLRAs), it is useful for state, interstate, regional, and national planning. However, MLRAs were not intended to provide meaningful comparisons for individual farm management decisions.

A classification system is needed that groups farming areas in the Pacific Northwest into units (zones) where similar agronomic and conservation tillage practices can be used. We have developed such a system

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of delineating agronomic zones for a five-county area in north-central Oregon. The zones can be located using only information from National Weather Service historical records and Soil Conservation Service soils data. Each agronomic zone features similar temperature, precipitation, and soil depth

characteristics, thereby providing a high probability for direct transfer of management practices and research information within a zone.

The five-county area (Figure 1) has a climatic and soils pattern typical of the interior Pacific Northwest. It is characterized by warm, dry summers and cool, wet winters. In the grain-growing regions of north central Oregon, more than 60% of the annual precipitation falls from November through April (Table 1). The major cropping rotation or sequence used at the present time is winter wheat-summer fallow, with a winter wheat-green pea rotation in selected areas where annual precipitation is higher.

Most areas of the interior Pacific Northwest depend upon overwinter soil water storage to produce crops. Optimum techniques for precipitation capture and storage differ from zone to zone. The potential utility of the zones lies in the uniformity of successful conservation tillage practices within each zone.

Herein, we explain the soil, precipitation, and temperature parameters that provide the best resolution of existing agronomic zones for the five-county area in north central Oregon. Also, we propose the use of these three parameters for delineating agronomic zones in other dryland wheat regions of the Pacific Northwest.

## Study methods

Major patterns of soil depth (Figure 2) in the five counties were determined from each county soil survey manual (1, 5, 6, 8, 9, 10). The general soils map in each county soil survey manual gives the soil association for

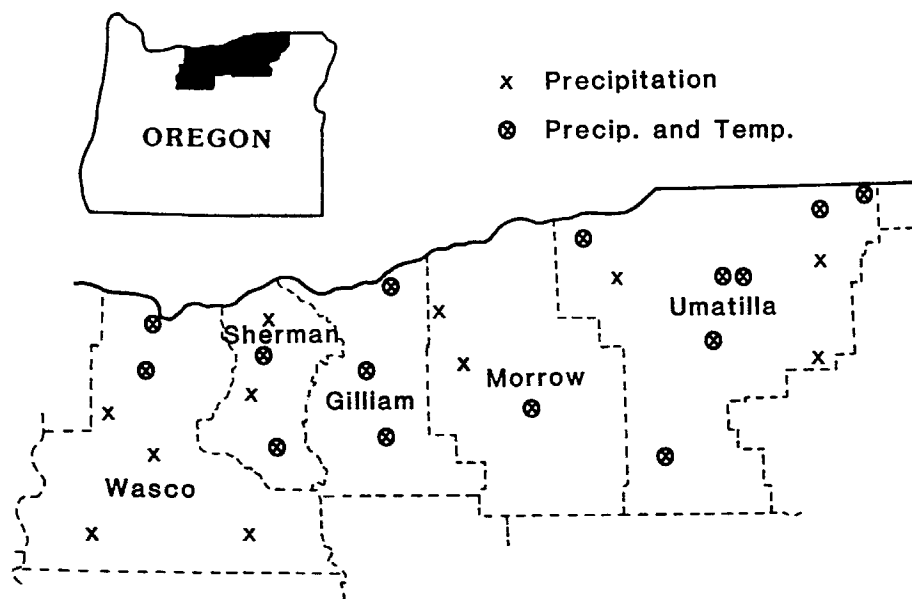


Figure 1. Location of study area in north central Oregon with weather stations reporting precipitation and/or temperature.