CURRENT STATUS AND RECENT TRENDS OF PALUSTRINE WETLANDS IN THE TUALATIN VALLEY, OREGON

by

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CURRENT STATUS AND RECENT TRENDS OF PALUSTRINE WETLANDS IN THE TUALATIN VALLEY, OREGON

ABSTRACT: Recent statistics have indicated a significant loss of wetland area to agricultural conversion has occurred in the second half of this century in the continental United States. Wetlands in the Tualatin Valley were examined for consistency with this trend. Acreage of non-linear palustrine wetlands in five classes were calculated for the years 1975 and 1988. The resulting data showed an overall decline in area of 10%. Over 85% of the decline was of the emergent class, for which an almost 20% decrease occurred since 1975. Sixty individual natural wetland areas disappeared. Seventy-five percent of this reduction can be attributed to agricultural conversion or alteration. Between 21 and 35% of the 1975 wetland area, mainly emergent wetlands, was found to be in some type of agricultural use in 1988. An estimated 67% of the 1988 wetland acreage was judged to have agricultural land uses adjacent to it, suggesting a potential for future alterations or conversions to agricultural use under the right conditions.

I. INTRODUCTION

In the last two decades there has been a significant increase in the attention given to our nation's wetlands by many environmental groups, government agencies, and scientists. Much of this increased attention is probably due to two well-publicized factors: a widespread recognition of the numerous important functions and values wetlands provide, and the documented trend of large reductions in wetland acreage in this half of the 20th century, due primarily to land conversions. Prime agricultural areas have been the scene of the heaviest conversions because of economic incentives to convert wetlands to agricultural use.

In response to this problem, the U.S. Congress inserted a wetland protection provision in the 1985 Food Security Act (U.S.P.L. #99-198). This "swampbusters" provision denies all farm program benefits to landowners who convert wetlands to crop production after December 23, 1985. Its effectiveness as a wetland protection tool is doubtful, however, because of implementation problems and continuing tax incentives for conversion (Heimlich & Langner, 1986). This paper will examine the status of wetlands in a prime agricultural area of the Willamette Valley, Oregon. The agricultural use and recent alteration or conversion of natural palustrine wetlands will be its focus. The impact of the "swampbusters" provision is beyond the scope of this paper, but its potential impact will be touched on. A separate study in the same research area will examine the effects of the "swampbusters" provisions on wetlands (Gallagher, 1989).

The paper is organized into four main sections. First is a brief discussion of the scope of the problem, basic wetland values, types of wetlands and classification schemes, and a description of the study area. Next is an outline of the objectives of the research and the methods used to meet them. The third section presents the results obtained. Conclusions and implications of the study comprise the last section. It is hoped this paper will shed some light on more recent conversion trends, the agricultural use of natural wetlands at the local scale, and the effectiveness of current wetland protection measures.

II. BACKGROUND INFORMATION

A) National Trends

Loss of wetland acreage became a serious problem in the latter half of this century, both nationally and in certain regions. One study completed in 1982 estimated the total wetland acreage in the mid-70's to be 99 million acres for the conterminous U.S., down 9 million acres from the mid-50's (Frayer, et al., 1983). This figure is somewhat misleading as the creation of over 2 million acres of open water wetlands (i.e., ponds) dampened the gross estimate of 11 million acres of natural wetlands lost.

Another study completed in 1982 came up with a figure of 78.4 million acres of non-federal wetlands remaining in the lower 48 states (Heimlich & Langner, 1986). This lower number is the result of excluding both federal wetlands, roughly estimated at 12.5 million acres, and conversions since the mid-70's. Annual conversions since the mid-70's have been estimated to be around 1.1 million acres, but this figure is considered highly questionable (Heimlich & Langner, 1986). There are no solid data on actual conversion rates since the mid-70's, but they are believed to be lower than the trends cited above.

The overwhelming majority of wetland acreage loss was of the palustrine vegetated types (i.e., non-tidal inland wetlands with water < 2 meters deep) as Figure 1 shows. Average annual loss of these types over the 1950-1970 period was 553,000 acres of which 300,000 acres was forested (e.g., swamps), 234,000 acres emergent (e.g., marshes and wet meadows), and the rest of the scrub-shrub variety (Frayer, et al., 1983). Nationally the emergent class experienced a 14% reduction, forested 10.8%, and scrub-shrub 3.5% from pre-1950's acreage levels (Frayer, et al., 1983). The most extensive documented wetland losses of this period occurred in the lower Mississippi River Valley, southern Florida, coastal North Carolina, the prairie pothole region, and Nebraska (Tiner, 1984 and Heimlich & Langner, 1986). Other areas of the U.S. were much less affected for the most part. However, many places, including Oregon's Willamette Valley, have little data on recent trends.

Agricultural conversion was deemed responsible for 87% of national wetland losses (Frayer, et al., 1983 and Tiner, 1984). Furthermore, virtually all of the wetlands converted to agricultural use were of the palustrine variety (Heimlich & Langner, 1986). Figure 2 presents the breakdown of both percent of acreage lost to various land uses and total acres lost to agricultural use of the three main palustrine types affected. These illustrations clearly show that agricultural conversion of palustrine vegetated wetlands is indeed the most serious aspect of the problem of shrinking wetlands acreage. Hence, lawmakers at all levels of government have attempted to address the source of the problem by implementing various wetland protection measures such as the "swampbusters" provision of the 1985 Food Security Act. In Oregon, a bill has been introduced in the 1989 legislative session to inventory and assess wetlands and to establish protection measures (S.B. #3).

B) Wetland Values, Types and Classifications.

Wetlands in their natural state provide many important values and functions benefitting society. Table 1 summarizes major wetland values in three general categories. In short, wetlands in their natural state provide numerous goods and services for people's use or consumption, a multitude of recreational, aesthetic, and other opportunities, and several important ecological functions. Most of these values are non-commercial and, therefore cannot be property assessed or priced by the market mechanism; they also exist in perpetuity, unlike most economic projects (Mitsch & Gosselink, 1986).

Converting wetlands to agricultural use produces goods which are readily priced in the marketplace. The converted values accrue primarily to individuals rather than the general public. The net result is a powerful incentive to private landowners to convert or use wetland acreage for economic gain. The problem to society is that when wetlands are altered or converted most of the values listed in Table 1 are lost, usually for good (Tiner, 1984). In summary, wetlands provide the greatest public benefits in their natural state.

The idea of what constitutes a wetland varies among individuals and agencies almost as much as types of wetlands vary in their natural state (Mitsch & Gosselink, 1986). However, the U.S. Environmental Protection Agency (EPA), Fish & Wildlife Service (USFWS), Army Corps of Engineers (COE), and Soil Conservation Service (SCS) have adopted a summary definition which requires the presence of all three of the following parameters: 1) hydrophytic vegetation; 2) hydric soil; and 3) a hydrology characterized by continuous soil saturation for a minimum of seven days during the growing season (EPA, 1989).

Broadly speaking, most wetlands fall into two basic types: coastal and inland (Mitsch & Gosselink, 1986). Examples of the former include both fresh and saltwater tidal marshes and mangrove swamps. Inland types include riparian wetlands, shallow lakes, marshes, swamps, and bogs, among others. The USFWS has devised an elaborate classification scheme which divides wetlands into major types using ecologically similar characteristics (Cowardin, et al., 1979). The classification is hierarchical ranging from a general system to a specific class based on observed vegetative, geologic, or hydrologic conditions.

Many other classification schemes exist, but the USFWS's is used by most U.S. agencies and organizations (Mitsch & Gosselink, 1986). The U.S. National Wetlands Inventory (NWI) was also based on it. However, many users feel it is too complex, confusing, and/or inconvenient and prefer simpler schemes (Mitsch & Gosselink, 1986). This study used an aggregated, simpler version of the USFWS classification. The aggregated version shows the spatial distribution of major wetland types much better than the NWI maps (Griffith, 1988). This simplified scheme will be explained later.

C) Study Area

The main portion of the Tualatin River Valley was selected for this study. It is located in southeastern Washington County in northwestern Oregon (Figure 3). The study area is approximately 110 square miles and is bounded on the north by the Forest Grove-Hillsboro-Beaverton urban growth boundary (roughly equivalent to Oregon Highway 8), on the east by the Beaverton-Tigard urban growth boundary and the county line, on the south by the county line, and on the west by the Coast Range foothills.

Land use within the study area is overwhelmingly agricultural as reflected by Table 5. Approximately 90 percent is in farm use, slightly less than half of which is irrigated cropland, mainly adjacent to the Tualatin River (Water Resources Dept., 1979). Around eight percent is forested, the bulk being the north slopes of the Chehalem Mountains, and two percent is urban. Obviously agricultural products are most important to the area's economy. In 1980 gross receipts from Washington County agricultural products totalled over

$81 million, ranking it eighth among Oregon counties (Washington County Planning Dept., 1981). There is a big diversity of agricultural commodities produced in the county - over 60 products - but several can be singled out as significant. In monetary terms specialty horticulture (greenhouse and nursery), wheat, and dairy are most important accounting for 50% of agricultural receipts. However, in terms of acreage wheat, hay/silage, and grass/legume seed are most important comprising 56% of the land in agriculture (Washington County Planning Dept., 1981).

Wetlands are important in the Tualatin Valley for all of the reasons listed in Table 1, but for two in particular; flood control and waterfowl habitat. The valley is known for being flood prone due to the high seasonal runoff, the lack of slopes on the riverbank, the low gradient for the lower valley, and a narrow gorge at river mile 6.5 which constricts the river's flow (U.S. Army Corps of Engineers, 1969). Five major floods have been recorded in the 20th century and large riverine areas are commonly inundated annually. Maintaining natural wetlands would appear to be an important way to dampen flood effects. As for waterfowl habitat, the valley is located along the pacific flyway and therefore its wetlands are important nesting and feeding areas for migratory species. In addition, many species winter in this region. For these reasons the USFWS has included the Tualatin Valley in one of its twenty-one waterfowl habitat areas of major national concern (Tiner, 1984).

III. RESEARCH DESIGN

A) Objectives

The study's first objective was to document recent trends in natural wetland alteration or conversion in the Tualatin Valley between 1975 and 1988. The intention was to generate data on numbers and acres of wetlands converted or altered and percentages of change for both. The data were grouped by five palustrine classes of wetlands and reflect each class's percent of the total. These data show a clear picture of the amount and types of palustrine wetlands present in the study area for both years and what has occurred to them in the interim. Classes or types which have been altered or converted the most were thereby highlighted.

A second objective was to determine whether or not the wetlands were being used for agricultural purposes and if so, what type of use is occurring on them. Resulting data were wetland acreage in each of three types of agricultural use, again organized by the five palustrine classes. Percentages of each class in each use type and percent of total wetlands in each use type were also included. The idea here was to discover the extent and intensity of the agricultural use of the valley's palustrine wetlands and which class or classes were being utilized the most by the local agricultural economy.

The last objective was to identify the land use adjacent to the wetlands. Data here took the form of estimated acres of each class surrounded by a general land use designation. Again, percentages of each class in each land use category and percent of total wetland acreage in each category were calculated. These data give an idea of the potential for future conversions or alterations of palustrine wetlands and the potential effectiveness of the "swampbusters" provisions of the Food Security Act of 1985.

B) Methods

To meet the first objective, acreage of all wetlands in the study area were calculated for the years 1975 and 1988. In order to do this, however, it was first necessary to classify the wetlands and decide on which classes to focus. As indicated earlier, a simplified classification scheme was chosen. This scheme grouped the wetlands into major USFWS vegetative types, seven of which accounted for over 99% of the study area's wetlands (Griffith, 1988). The seven were: forested, emergent, scrub-shrub, open water, riverine (upper perennial), riverine (lower perennial), and aquatic bed. It was decided to exclude the riverine wetlands which are non-vegetated wetlands contained within a channel (Cowardin, et al., 1979). It was assumed that they would show little, if any, change or agricultural use.

The simplified scheme also took the USFWS's 14 hydrologic regime modifiers and combined them into two: permanent and non-permanent, in regard to surface water. After reviewing the study area's wetlands it became apparent that even this distinction was not needed as there was little difference. It should simply be noted that all open water and aquatic bed wetlands were permanent except one and all other wetlands were non-permanent except six emergent and one forested.

The third decision involved discarding all linear wetlands. Computing acreage for them would have been next to impossible and they probably would not have added any significant information to this study anyway as most have no associated land use. Hence, what remained was all non-linear palustrine wetlands in five classes:

emergent, wetlands having erect, rooted, herbaceous hydrophytes; forested, wetlands with woody vegetation at least 6 meters tall; scrub-shrub, wetlands with woody vegetation under 6 meters in height; aquatic bed, wetlands with plants growing on or below the water surface; and open water, wetlands without significant vegetation, less than 20 acres in area, and less than 2 meters deep at low water (Cowardin, et al., 1979).

For 1975 wetland data eight NWI maps, based on USGS 7 1/2 minute quadrangles, were used. The eight maps were: Forest Grove, Hillsboro, Gaston, Laurelwood, Scholls, Beaverton, Newburg, and Sherwood. The first map's scale was 1:62500, all others were at 1:24000. Palustrine wetlands within the study area were first identified and numbered. Acreage was then computed on the Department of Geography's AUTO-CAD system using a program to calculate area. Wetland polygons were digitized into areas in square inches and then converted to square feet, then acres.

Acquiring the 1988 wetland data was much more difficult. To begin with all 1975 NWI wetland areas had to be located on color slides in the possession of the Hillsboro office of the USDA Agricultural Stabilization and Conservation Service (ASCS). These slides were taken by a contractor in July of 1988 at a scale of roughly 1:6000. Identification of wetlands was done using these slides in conjunction with the 1975 NWI maps and ASCS 1:6000 orthographic aerial photo sheets taken in the summer of 1980. With these sources, locating the 1975 NWI wetlands, or where they ought to be, on the slides was not overly difficult. Calculating acreage presented some problems, though. A Numonics brand computer planimeter was used. Where wetland polygons showed no change in shape or area between the three sources acreages were computed off the 1980 ortho photos, a rather simple procedure of tracing along the wetland's outer edge and hitting a button for instant acreage figures. This method was also employed if the 1988 slides indicated all changes in area had occurred prior to 1980, or if distinct features existed in and around the wetland area enabling interpolation from the slide to the ortho photo. In other cases, measurements were done directly off the slides, which meant a cumbersome tilt-compensation procedure was required in order to adjust the slide's scale to the ortho photo's so that the planimeter could correctly calculate acreage. This procedure involved selecting four matching points on each source and getting a resulting digital readout of ten or less for reasonable accuracy ($\leq$ .01 acre).

Manual interpretation of the color slides was used to answer the change/trends, type of agricultural use, and adjacent land use questions. Presence/absence of vegetation or water, shades of green or brown, patterns, and obvious features were the primary distinguishing criteria. Approximately 30 locations were field checked to evaluate the interpretation process and, in some cases, to identify the use or status of a wetland labelled as unsure. In the former circumstance they generally upheld the validity of the interpretation process and subsequent designations. In the latter case they usually enabled a decision on use to be made.

For type of agricultural use, an original classification scheme was devised. It was based largely on intensity of management or use and contained three somewhat broad classes: an intensive one, where the land is cultivated and/or irrigated, and harvested, primarily with annual crops; a passive one where only perennial crops are raised or other light farm use occurs (e.g., pasture); and an unsure class where past or present farm use is fairly obvious, but type of use isn't.

Regarding adjacent land use, it was decided that a general classification was enough to meet the objective and to employ an already established one. The classification developed by the USGS for use with remote sensor data was chosen as it addresses the needs of rural areas very well (Anderson, et al., 1976). It is hierarchical, moving from a general Level I class to a more detailed level as specific as the user desires. This user chose to stay at Level I because more specific types of agricultural use were covered by another classification.

IV. RESULTS

A) Wetlands 1975-1988 and Changes 1975-1988

The 1975 NWI maps showed a total of 390 non-linear palustrine wetlands within the study area (Table 2). The most, 151 or 38.7%, were of the emergent type. Open water areas were a close second with 123 or 31.5%. The fewest wetlands were of the scrub-shrub and aquatic bed types with 19 and 17 areas respectively. Total acreage of the 390 wetlands was approximately 2322 acres. Again, the emergent class led the way with 988 acres or 42.7% of the total. However, this time forested wetlands were a close second with 960 acres or 41.3%. Aquatic bed areas accounted for the least acres, 48 (2%). Table 2 shows the breakdown for the other classes. Average wetland size by class was 6.5 acres for emergent, 12 acres for forested, 4.8 for scrub-shrub, 2.8 for aquatic bed, and 1.9 for open water.

Identifying and evaluating the 1975 NWI wetlands on 1988 color slides provided the following figures, summarized in Table 3. Total wetlands were now 330, a loss of 60 individual wetlands, or 15% of the

1975 number of wetlands. The emergent class was most affected losing 48 areas, an almost 32% reduction. Open water wetlands experienced a significant loss as well with 17 areas disappearing, a 14% decline. Conversely, the scrub-shrub and aquatic bed classes increased in number by six and one respectively. Forested wetlands did not significantly change. The wetland acreage now totalled 2097, down 225 acres or 10%. The vast majority of this loss (193 acres) occurred in the emergent class, which declined almost 20%. This lost acreage moved the emergent class behind forested wetlands in percent of total. In 1988, the forested class accounted for 45% of the total while the emergent class accounted for 38%. The only other significant results were a 12% reduction in open water acreage and a 15% increase in the scrub-shrub class.

The cause of the drop in emergent acreage was primarily conversion or alteration to intensive agricultural use as reflected by column 1 of Table 4. Seventy-five percent of the 193 acres was attributed to this factor. In addition, 50% of the lost open water acreage (13 acres out of 25) were areas drained or dried-up, presumably because of irrigation withdrawals. If this assumption is true agricultural use is responsible as well. The reason for the 14 acre scrub-shrub increase was natural succession of emergent wetlands.

There were two problems encountered during this phase of the research. One involved acreage discrepancies. Wetland areas were measured off two different sources using two different methods so degrees of accuracy differed and thus, acreage figures. This was evidenced by the fact that areas of some wetlands that obviously had not changed appreciably between 1975 and 1988 did not coincide exactly. Therefore, the reliability of the figures could be poor and acreage in Tables 4 and 5 (calculated off ASCS slides) would not match those in Table 2 (computer using AUTO-CAD). This problem was solved by adjusting the 1975 acreage. Thirty-one wetland areas (mainly open water) were identified as being not appreciably changed. In all but one of them the 1975 figure was larger than the 1988 figure. By subtracting the 1988 acreage from the 1975 number, summing the results, and dividing that by 31, an average discrepancy of about 1 acre was obtained. Since the test showed 1975 figures to be almost always higher, 1 acre was subtracted from all 1975 wetlands over 3 acres in size. This procedure and rounding the acreage figures to whole numbers enabled the totals in Tables 2, 4 and 5 to be matched. Hence, the resulting numbers should be viewed as close estimates and not be perceived as absolute.

The second problem had to do with what the USFWS defined as a wetland and therefore mapped in the 1975 NWI. Since the trends analysis was based on this it was a very critical question. Theoretically no farmed wetlands were mapped in 1975, meaning mechanically tilled or altered, or wetlands managed for agricultural use (Peters, 1989). If this is interpreted literally then additional acreage should be considered as converted to agricultural use and subtracted from Table 3 based on the interpretation results presented in Table 4. In other words, the passive category would in that case be considered altered also, not just the intensive one, since in 1975 is was mapped only if it was not managed for agriculture. This would drastically change the data for the emergent class, lowering its acreage 280 acres and increasing its decline to -48%. However, in reality most of these "passive" wetlands (e.g., grass seed fields and pastures) were probably mapped as NWI wetlands as they are extremely hard to differentiate, especially at the scale used in 1975 (Mackinson, 1989). Therefore, in Table 3 it was assumed that "passively" used wetlands haven't changed or been altered from their 1975 condition (that of managed for agricultural for the most part). Thus, they were included in the 1988 unaltered wetlands totals.

Conversely, there is a distinct possibility that a certain percentage of wetlands labelled as intensively used in Table 4 were mapped in 1975 (Mackinson, 1989). So, for example, if 25% of the emergent, intensively used acreage was mapped as wetland in 1975, the Table 3 figures would change to 831 and -16%. In all likelihood this mistake was probably relatively rare so it was decided to exclude all wetlands in the intensive category in Table 4 from the 1988 totals and count them as areas of change. As one can see from the tables this dilemma primarily affected the emergent class. The intent here was merely to make the reader aware of the situation and the implications thereof.

B) Agricultural Use of 1975 Wetlands, 1988

Table 4 presents the interpretation results of the agricultural use of the 1975 NWI wetlands. As can be seen, 65% of the wetland acreage actually was not in agricultural use at all. This included 97% of the forested acres, all of the scrub-shrub wetlands, and almost half of the emergent class. Open water wetlands in forested areas were assumed not to be used for agricultural purposes and also included.

Agricultural use of the wetlands in 1988 was estimated to range from 21% to 35%. Seven percent (158 acres) were identified as being in intensive use, meaning annually cropped, irrigated or cleared land, or land in orchards or nurseries. Over 91% of wetland acreage in this category was of the emergent class, 15% of its total. Thirteen acres of open water wetlands and seven forested acres incorporated into fields made up the remainder. Some of the open water acreage were dry ponds. These were assumed to be drained by irrigation and were included as altered wetlands.

Fourteen percent or 330 acres of the total were labelled as being in passive use, meaning perennial crops such as grass seed and hay, obvious pastures, and fallow fields. Almost 98% of these lands fell in the emergent class, over 32% of the total. This means that with the intensive acreage, over 47% (467 acres) of emergent wetlands were being used for agricultural purposes. In addition, 13% or six acres of aquatic bed wetlands were in passive use. Less than one percent of forested wetlands were in farm use.

An unsure category was added to the table for wetland areas where a decision could not be confidently made. This category contained 14% of the total wetland acreage, but 73% of that is in the open water and aquatic bed classes. This is because these areas with year-round surface water showed no obvious farm use. In all likelihood a high proportion of them are in fact used for irrigation or watering livestock, but rather than make that assumption for all, it was decided to lump them into this category. Therefore, if all unsure acreage is included, 35% of the total wetland acreage is in agricultural use. However, only 21% can be labelled as such with a high degree of confidence.

C) Adjacent Land Use, 1988

Interpretation of the 1988 slides resulted in data in six land use categories, illustrated by Table 5. As expected, the majority of land uses adjacent to the 1975 NWI wetlands were agricultural. The estimate of wetland acres surrounded by agricultural use was 1427 acres, 62% of the total. In all classes, except one, the majority of its acres were thus surrounded. The forested class had 471 acres or 49% with adjacent agricultural land uses, just shy of a majority.

Nineteen percent of the total wetland acreage was surrounded by water, primarily forested wetlands along the Tualatin River. Riverside forested wetlands accounted for over 86% of the water category and 39% of the forested class. Other wetlands were adjacent to 217 wetland acres (9%). Over half of this was emergent acreage representing 12% of that class's total. The scrub-shrub class registered 18 acres in this category and had the largest percentage at 20.

Urban land uses were not very significant being adjacent to only 3% of the wetlands. This is not surprising as most urban areas were excluded from the study area. Emergent wetlands accounted for almost 70% of the 67 acres surrounded by urban uses, but this was only 4.5% of the total emergent class. Less than 1% of the wetlands were surrounded by barren uses. These six acres had a transitional land use next to them or, in one case, a quarry.

V. CONCLUSIONS

The data seem to indicate that alteration or conversion of wetlands to agricultural use was not a problem for 4 of the 5 classes in the Tualatin Valley from 1975 to 1988. Overall there appears to have been little change in wetland acreage between these years. Only 225 of 2322 natural wetland acres were lost, a 10% reduction in area, although 60 individual wetland areas did disappear. However, the emergent class was seriously affected, experiencing a loss of 48 areas and 193 acres, a 31.8% and 19.5% decline respectively. Some of this decline can be attributed to natural succession which accounts for the 14 acre increase in scrub-shrub wetlands. But the bulk was due to agricultural expansion which is consistent with national trends. Therefore, loss of natural palustrine emergent wetlands to agricultural use was significant during this time period.

The above statements are based on the assumption that no annual croplands were mistakenly mapped as wetlands in 1975. If a certain portion of them were mapped in 1975, which is possible, then the statistics are somewhat inflated and the alterations of emergent wetlands to agricultural use was less significant or serious during this time. On the other hand, it was also assumed that all grass seed fields, hay fields, improved pastures, and the like were inadvertently mapped as wetlands in 1975. If a certain portion of these wetlands were not in managed agricultural use in 1975, which is also possible, then the statistics are too low and the alterations of emergent wetlands to agricultural use was a very serious problem indeed.

Changes or trends notwithstanding, the data clearly show that at least 21% and possibly as much as 35% of the wetland acreage mapped in 1975 was being used for agricultural purposes in 1988. As with the trends, the emergent class was most affected. Almost 50% of emergent acreage was in some form of farm use in 1988. Hence, it can be concluded that half of the emergent wetland acreage is not in natural vegetation. The other vegetated classes have remained in their natural state for the most part.

An estimated sixty-two percent of the wetland acreage was surrounded by agricultural land uses. In all classes except forested, the majority of acres had this adjacent land use. Again, the emergent class was most significant with 686 acres or 70% of its total in this situation. This suggests that over half of the wetland acreage, approximately 1400 acres, is potentially susceptible to agricultural conversion or alteration if favorable economic conditions existed. A recent economic analysis, which found approximately 74,000 wetland acres of the Willamette Valley - Puget lowlands area to have a high to medium conversion potential, supports this notion (Heimlich & Langner, 1986). In addition, a region 10 wetlands threat assessment conducted by the U.S. Environmental Protection Agency listed Washington County as an area with a growing conversion threat (Oregon Division of State Lands, 1988).

It appears then that in this predominantly agricultural valley the "swampbusters" provisions of the 1985 Food Security Act may be able to have a positive influence on future conversions or alterations of wetlands. But this could happen only if landowner participation in ASCS programs is high and the benefits from them outweigh economic returns from farmed wetlands. Future research will undoubtedly evaluate its effectiveness.

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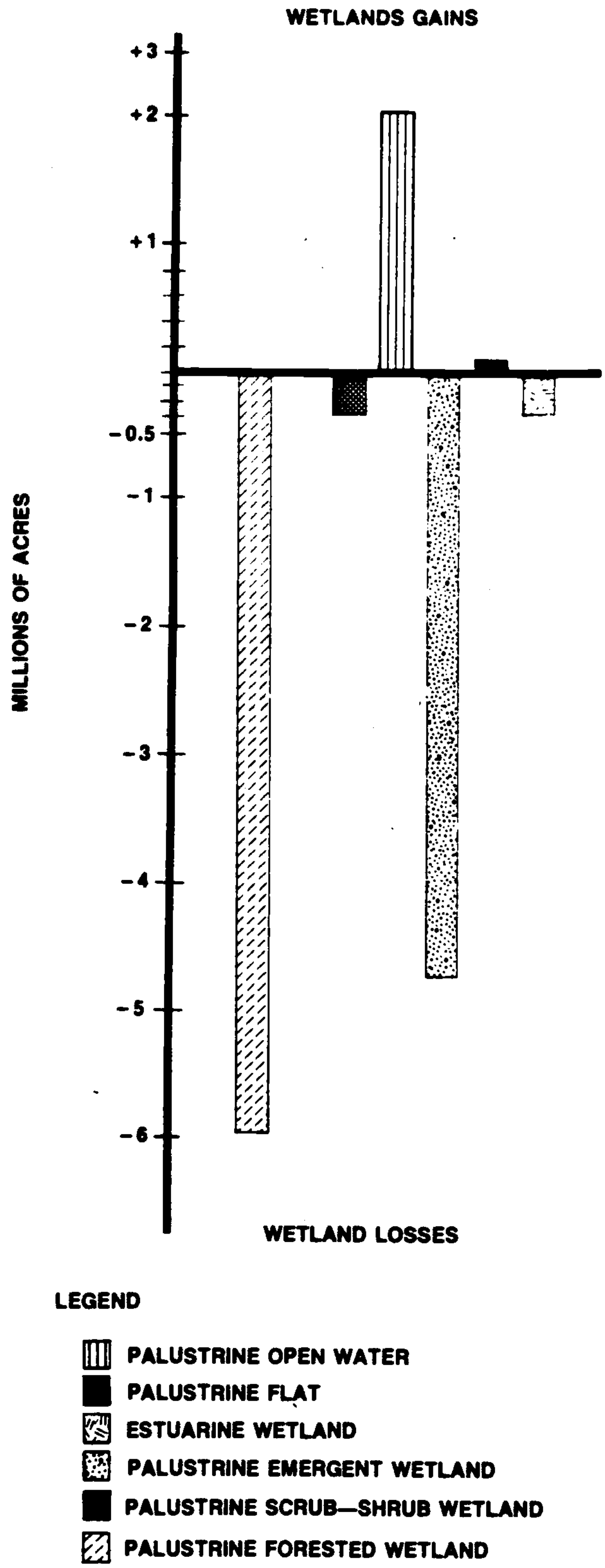
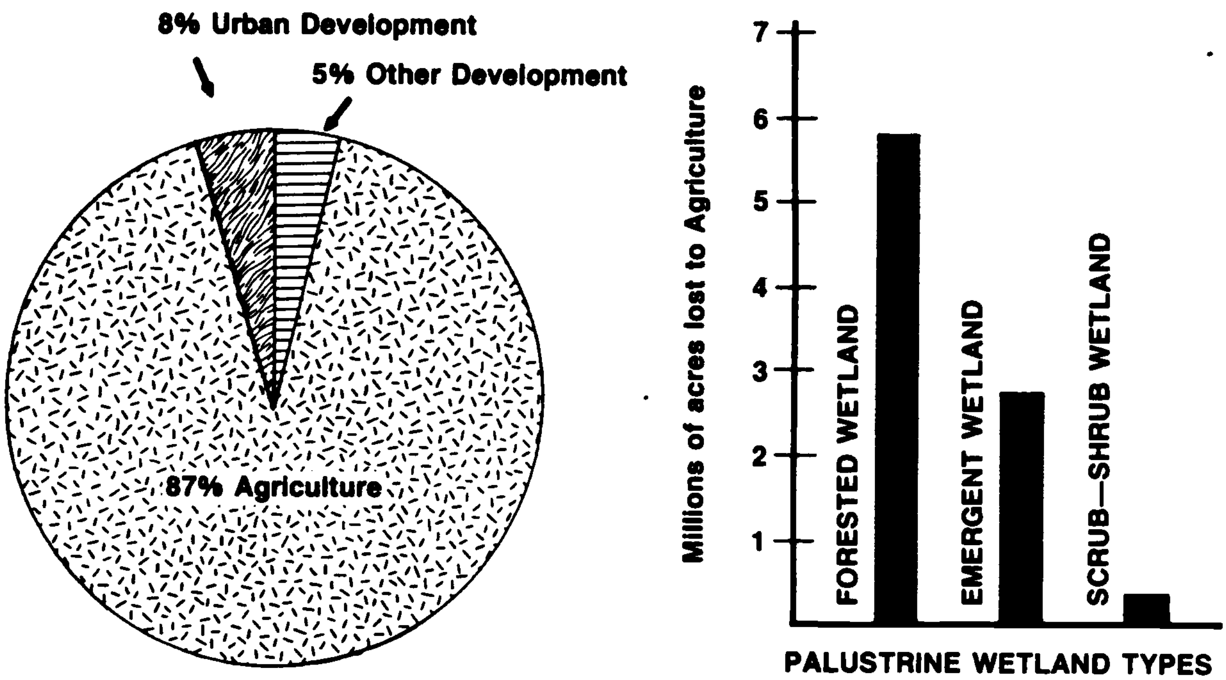
Figure 1.



Net losses and gains in wetlands of the conterminous U.S. between the mid-50's and mid-70's (from Frayer, et al. 1983).

Figure 2.



Causes of recent wetland losses (mid-1950's to mid-1970's) in the conterminous U.S.; losses to agriculture are highlighted (from Frayer, et al. 1983).

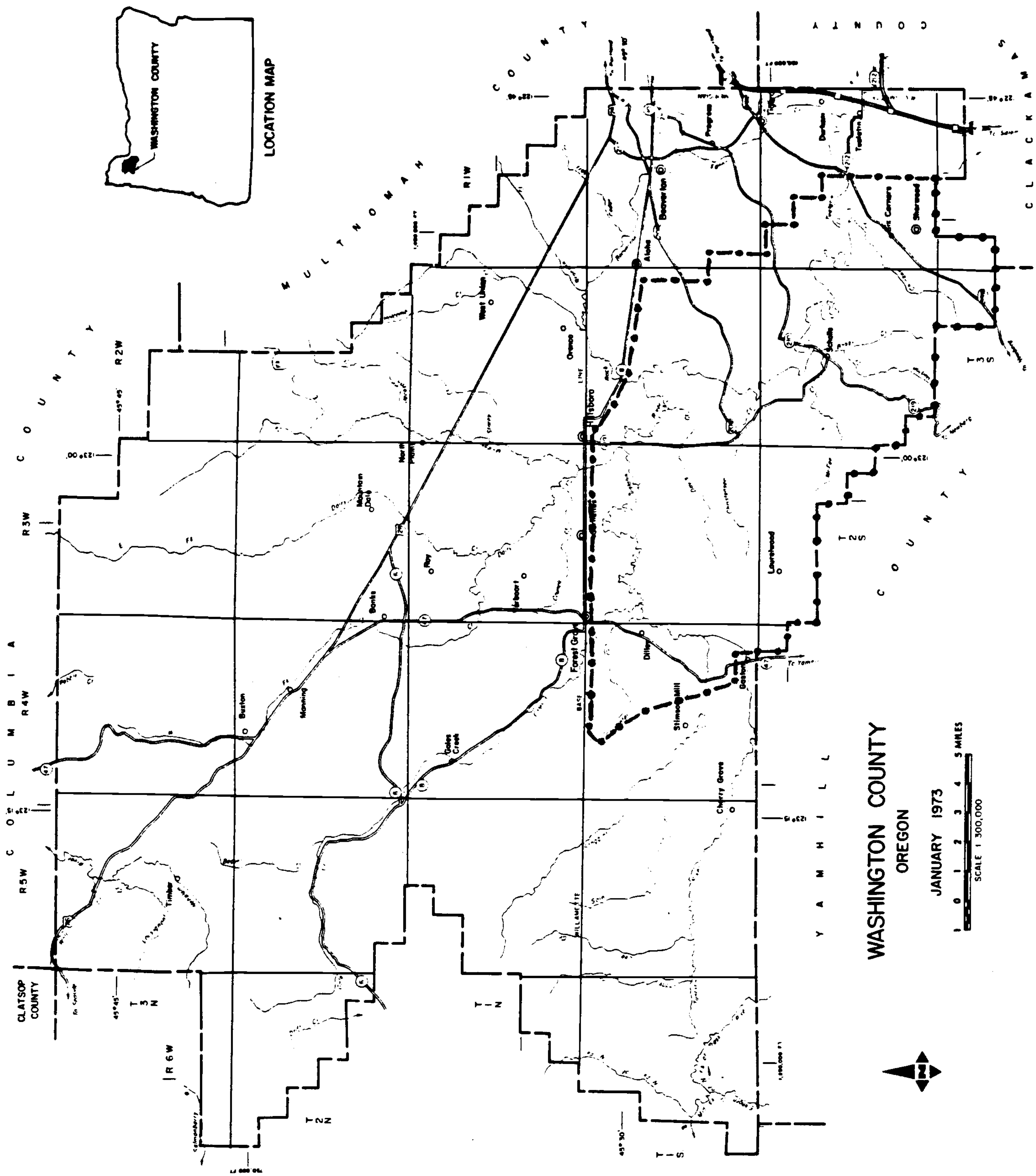


FIGURE 3: Location of study area

—·— approximate boundary of study area

Source:
Base map prepared by SCS, WTSC Carto Unit from 1:126,720 General Highway maps.

U.S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE

USDA-SCS-FORT WORTH TEXAS 1984

M7-EL-22476-34A BCD

Table 1. *List of major wetland values.*

FISH AND WILDLIFE VALUES
- Fish and Shellfish Habitat
- Waterfowl and Other Bird Habitat
- Furbearer and Other Wildlife Habitat

ENVIRONMENTAL QUALITY VALUES
- Water Quality Maintenance
  - Pollution Filter
  - Sediment Removal
  - Oxygen Production
  - Nutrient Recycling
  - Chemical and Nutrient Absorption
- Aquatic Productivity
- Microclimate Regulator
- World Climate (Ozone layer)

SOCIO-ECONOMIC VALUES
- Flood Control
- Wave Damage Protection
- Erosion Control
- Groundwater Recharge and Water Supply
- Timber and Other Natural Products
- Energy Source (Peat)
- Livestock Grazing
- Fishing and Shellfishing
- Hunting and Trapping
- Recreation
- Aesthetics
- Education and Scientific Research

Source: Tiner, 1984.

TABLE 2 - 1975 WETLANDS[1]

CLASS	#	% OF TOTAL	ACRES	% OF TOTAL
Emergent	151	38.7	988	42.7
Forested	80	20.5	960	41.3
Scrub-Shrub	19	4.9	91	4.0
Aquatic Bed	17	4.4	48	2.0
Open Water	123	31.5	235	10.0
TOTAL	390	100.0	2322	100.0

Source: National Wetlands Inventory maps

[1]Includes only non-linear palustrine wetlands; acreage figures rounded to nearest whole number.

TABLE 3 - 1988 UNALTERED WETLANDS[1]

CLASS	#	% OF TOTAL	% CHANGE FROM 1975	ACRES	% OF TOTAL	% CHANGE FROM 1975
Emergent	103	31.2	-31.8	795[2]	38.0	-19.5[2]
Forested	78	23.6	-2.5	942	45.0	-2.0
Scrub-Shrub	25	7.6	+1.32	105	5.0	+15.0
Aquatic Bed	18	5.5	+1.05	45	2.0	-<1.0
Open Water	106	32.1	-14.0	210	10.0	-12.0
TOTAL	330	100.0	-15.4	2097	100.0	-10.0

Source: U.S. Agricultural Stabilization & Conservation Service slides

[1]Excludes all wetlands identified as being in intensive agricultural use (category #1 in Table 4), all dry open water areas, altered wetlands in non-agricultural use, and any wetlands not included in the 1975 inventory.

[2]Based on assumption that only wetlands in cultivation and/or wetlands intensively managed for agricultural use were not mapped in 1975. Thus 795 and -19.5% are conservative figures, actual numbers could be as low as 515 and -48%.

TABLE 4 - TYPE OF AGRICULTURAL USE OF 1975
NWI WETLANDS, 1988 (in acres)
(With percent of class total)

CLASS	INTENSIVE[1]	PASSIVE[2]	UNSURE[3]	NONE[4]	TOTAL
Emergent	145 (15%)	322 (32.5%)	70 (7%)	451 (45.5%)	988
Forested	7 (<1%)	2 (<1%)	18 (2%)	933 (97%)	960
Scrub-Shrub	0	0	0	91 (100%)	91
Aquatic Bed	0	6 (13%)	27 (56%)	15 (31%)	48
Open Water	13 (5.5%)	0	212 (90%)	10 (4.5%)	235
TOTAL	158	330	327	1500	2322
% OF TOTAL	7%	14%	14%	65%	100%

Source: U.S. Agricultural Stabilization and Conservation Service slides

[1]Includes all annual cropland, irrigated land, orchards, nurseries, areas of cleared farmland, and any dry open water areas in farm use areas.

[2]Includes grass seed, fallow, and hay fields and obvious pastures.

[3]Possible pasture, abandoned pasture, or fallow field. Land has no history of entry in an ASCS program and appears as open space. Includes all intact open water and aquatic bed wetlands in farm use areas.

[4]Definitely not used for agricultural purposes; appears as a naturally vegetated wetland. Includes all open water wetlands in forested areas.

TABLE 5 - ADJACENT LAND USE TO 1975 NWI WETLANDS, 1988 (in acres)

(with percent of class total)

CLASS	URBAN OR BUILT UP	AGRICUL-TURAL	FOREST	WATER	OTHER WETLANDS	BARREN	TOTAL
Emergent	46 (4.5%)	686 (70%)	76 (8%)	56 (5.5%)	122 (12%)	2 (<1%)	988
Forested	7 (<1%)	471 (49%)	37 (4%)	378 (39%)	65 (7%)	2 (<1%)	960
Scrub-Shrub	2 (2.2%)	54 (59%)	13 (14.3%)	4 (4.4%)	18 (20%)	0	91
Aquatic Bed	3 (6%)	33 (69%)	7 (15%)	0	4 (8%)	1 (2%)	48
Open Water	9 (4%)	183 (78%)	33 (14%)	1 (<1%)	8 (3.4%)	1 (<1%)	235
TOTAL	67	1427	166	439	217	6	2322
% OF TOTAL	3%	62%	7%	19%	9%	<1%	100%

Source: U.S. Agricultural Stabilization and Conservation Service slides