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AN HISTORICAL ANALYSIS OF AGRICULTURAL LAND USE
DYNAMICS IN DELAWARE'S COASTAL ZONE

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This paper presents one component of a larger research project which was conducted to provide a source of data on historical land use trends in the Delaware Coastal Zone. That study used its established data base to predict how past land use patterns may be altered in the future, due to potential Outer Continental Shelf (OCS) onshore impacts. Primary data were generated for selected regions in Delaware's and Louisiana's Coastal Zone to accomplish the study's intended purposes. One of the important characteristics of the effort was the evaluation of the manner in which gross land use changes occurred in and out of selected categories. Most land use analyses have depicted only net changes, which can mask dynamically shifting phenomena. This paper demonstrates the utility of analyzing both the gross and net changes in agricultural land use for the period 1954-73.

Purpose of the Study

The issue of agricultural land use dynamics has promoted both Nation-wide and more localized concern recently. The justification for this concern is duly warranted. It has been estimated the the National loss of prime farmland is about one million acres per year, or 2,750 acres each day. A good portion of that loss is due to developmental pressures. It seems "...that development is drawn disproportionately to prime farmland." The reasons for this development are that:

...a disproportionate share of America's prime farmland lies within areas of urban pressure; is served by the most intensive network of transportation, energy, and communications systems; and has soil and topographic qualities that minimize site development costs. (Sampson, pp. 4-6).

This phenomenon has been aggravated in the Northeast between 1967 and

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1975. During this interval, the region lost over two times as much prime farmland as remained in reserve for future use. Delaware, situated in this region, has not escaped these pressures. In 1954, Delaware had 814,316 acres of total farmland, while in 1974 only 630,605 acres remained. Furthermore, the recent drop in cropland has also been alarming - from 505,356 acres in 1969 to 483,342 acres in 1974. Most of this declining farmland was due to suburbanization of "sprawl." (State of Delaware)

The importance of agriculture to Delaware is multi-fold. The agricultural sector continues to be the largest single user of land in the state. The resultant food products are valuable not only to Delaware's residents, but also the the regional food supply. Broilers, corn, soybeans, and vegetables are some of the leading commodities accounting for Delaware's national fourth-ranking net income per farm status. Besides being vital to the economy, farmlands provide scenic and recreational opportunities for residents and tourists, often being the primary segment of "open space" considered during land use planning.

In Delaware, it has been shown that, while the numbers of farms continue to decline, the average farm size has consistently increased. The major factor contributing to this phenomenon is "economies of scale." That is, as equipment and farm practices become more sophisticated and expensive, it becomes increasingly more economical to farm larger and larger land tracts. (Delaware State Planning Office) This factor, along with the increasing application of drainage techniques to previously untillable land areas, has allowed for a somewhat anomalous situation to have occurred in southeastern Delaware in the past years. Specifically, this area has shown a significant decrease in total farmed land between 1930 and 1964, but it concurrently experienced a dramatic increase in harvested cropland (Vaughn).

To provide further insights into the dynamics of the all-important agricultural land uses in Coastal Delaware, it was felt that a detailed evaluation was warranted. This involved the derviation of an analytical technique which would further demonstrate the manner in which the agricultural land use categories changed.

Procedural Methodology

The Delaware study region for this project is delineated in Figure 1. It's 154,000 acres generally encompass the majority of Delaware's ocean shore and the Rehoboth, Indian River, and Little Assawoman Bays' watershed basins of Sussex County, the southernmost of Delaware's three counties.

The procurement of a land use data base required the development of time-series land use maps for the study region. These maps were generated from available aerial photography and were also scaled to United States Geological Survey (USGS) 7.5 minute topographic sheets. Time-series aerial imagery was obtained from the United States Department of Agriculture for 1954. These photographs were black-and-white prints at a scale of 1:20,000. Photographs for 1973 were obtained from various sources and were color or color-infrared transparencies of high quality resolution and variable scale. USGS topographic sheets for 1954 were secured for the entire region, while the vast

FIGURE 1. Vicinity Map of the Delaware Study Region
Map Source: [5]

majority of the area was also covered by 1972 photo-revised sheets. Scale for all sheets was 1:24,000.

Appropriate land use categories which adequately describe land use and land cover patterns for the area were also developed. The particular categories were chosen after conducting a thorough literature search, experimenting with aerial photo interpretation and mapping techniques, and considering the particular needs of the region and the study. The resultant listing of twenty singular and seventy-two mixed (or multiple-use) categories was determined broad enough to be generally interpreted, yet specific enough to fulfill the project's data requirements.

Photographic interpretation and mapping proceeded once the appropriate categories were selected. Aerial imagery was used in conjunction with the applicable USGS topographic sheet. The sheet was placed on a drawing board with tracing paper taped over it. It should be stressed that the sheet was used only for drawing clarification (i.e., scale) and orientation and not for tracing. By using a Bausch and Lomb Zoom Transfer Scope, the particular photographic image was superimposed directly upon the topographic sheet at the correct scale. Drawing thus became simple and needed little re-orientation between map and photo.

After the maps were completed, the areal extent of all categories was calculated in square inches and converted to acres. This was accomplished using two processes - the Keuffel and Esser polar planimeter method and the dot-grid method, with the latter proving to be more accurate and useful. Once acreages were determined, all results were tabulated in a fashion allowing for simple data retrieval.

After the time-series mapping process was completed, transparent acetate and translucent mylar overlays were reproduced from the tracing paper maps. These overlays were then compared for each subregion to discover zones of land use change between 1954 and 1973. A third map series (the 1954/1973 land use change series) was then developed, delineating only this change. The areal distribution of each category-change pattern was calculated in square inches and eventually converted to acres. The results were tabulated, in concert with the previously obtained time-series data, to show land use change patterns, the degree of change, and the significance of those changes.

To conduct the agricultural analysis which would define not only net land use changes, but also gross shifts which would otherwise be masked by net values, a specific analytical routine was developed. This involved the use of the classification and hierarchal system presented in Table 1. This tabulation organizes the study's twenty singular land use categories into two groups - "developed" and "non-developed" - segregated according to the relative influence of man upon them (i.e., construction-oriented versus non-construction-oriented uses). These were further classified into a hierarchal system to qualitatively evaluate the manner in which quantitative land use changes had occurred. As portrayed in Table 1, a developmental change was one in which a plot's land use showed an increasing effect of man's influence. Thus, the twenty categories were not only organized according to whether they were "developed" or "non-developed," but were further defined within those two broad groupings. Accordingly, the higher end of the developed scale showed more intense human influences than did the lower end. The

Table 1
Classification and Hierarchal Analysis of
Developed and Non-developed Categories.

Developed Categories (and Symbols) ^a	Relative Hierarchy ^b	Non-Developed Categories (and Symbols) ^c	Relative Hierarchy ^d
Industry (I)	Most Intense	CROPLAND (A)	Less Passive
Commerce (C)		ORCHARDS (O)	
Strip Development (S)		PASTURES & FIELDS (P)	
Military (MI)			
Residential (R)	More Passive	Beaches (B)	More Passive
Mobile Residential (RM)		Dunes (D)	
Transportation (T)		Enclosed Water Bodies (E)	
CONFINED ANIMAL FACILITIES		Forests (F)	
		Forests (F)	
Man-made Waterways (M)		Sand (SND)	
Transitional Idle Land (IL)		Streams (STR)	
		Wetlands (W)	

^aMixed categories classified as "developed" if any singular member of mixed set is "developed."

^bCategories become progressively more intensely developed (i.e., increase in human activity/use/density), reading from bottom to top.

^cMixed categories classified as "non-developed" if all singular members of mixed set are "non-developed."

^d"A," "O," and "P" are each "less passive" than the other seven categories; however, no distinction is made within the "less passive" or "more passive" groupings.

non-developed classification was slightly different, because no attempt was made to interpret relative intensity of natural (i.e., ecological) plant succession or land cover changes. Thus, only the vegetated agricultural categories were determined to be, as a group, less passive than the other land cover categories, as a group. Therefore, a land use change could be determined to be developmental within the non-developed groupings, if it transformed from a more passive to a less passive sub-grouping.

The agricultural inspection technique takes this process one step further by defining a developmental and a non-developmental change into a "primary" or "secondary" status. Specifically, a change was considered to be primary if it shifted between the developed and non-developed groupings. On the other hand, a secondary change was defined as occurring within either grouping. This would demonstrate a higher level of sophistication in evaluating land use changes, i.e., a primary change would have far more environmental/socio/economic impact than a secondary change, under most circumstances.

For example, shifts from "R" to "AP" and from "P" to "W" would be considered secondary non-developmental changes. Conversely, changes from "AP" to "R" and "W" to "P" would be classified as secondary developmental changes. But "R" to "R" and "AP" to "W" shifts would both be considered primary non-developmental changes. And to complete the realm of "singular" examples, changes from "P" to "R" and "W" to "AP" would be called primary developmental changes. Changes involving mixed categories consistently followed the schemes set forth under Table 1's formulation and for the "singular" analysis illustrated above. This overall approach provides a scenario around which to conduct the detailed agricultural analysis.

Presentation of Results

Table 2 displays the results obtained after analysis of the research project's data base for the four singular agricultural categories ("A" - Cropland; "AP" - Confined Animal Facilities; "O" - Orchards; and "P" - Pastures) using the above methodology. Only the four singular categories were chosen for this paper because they are the four most representative land use classifications relevant to the study's purpose.

Cropland

Cropland, by far, demonstrated the greatest number and magnitude of land use changes over the nineteen year interval. Of the gross loss from cropland, just over half (56 percent) became a developed category, while just under half (44 percent) became non-developed. However, these statistics were dominated by two of the four components, i.e., the great bulk of the developmental change was considered primary (49 percent of the total loss), while all of the non-developmental change was secondary.

The cropland gross gain analysis showed a clear dominance of secondary developmental change (74 percent of the total gross addition). The non-developmental figures were split about two to one in favor of the primary

Table 2

Analysis of Agricultural Categorical Primary Versus Secondary
Developmental and Non-Developmental Changes.

Acres Changed from Ag. to other Categs. (Δ_1) & percent Gross Change ^d	Acres Changed from Other Categs. to Ag (Δ_2) & percent Gross Change ^b	Net Change in Cat. Acres $\Delta_2 - \Delta_1$ (Δ_3) & percent Net Change ^c	Acres Changed from Ag. to other Categs. (Δ_1) & percent Gross Change ^a	Acres Changed from Other Categs. to Ag. (Δ_2) & percent Gross Change ^b	Net Change in Cat. Acres $\Delta - \Delta_2$ (Δ_3) & percent Net Change ^c
- Cropland ("A") -			- Confined Animal Facilities ("AP") -		
1° Dev. Ch. ^d :	1° Dev. Ch:	Net 1° Dev. Ch:	0	438.9622	438.9622
2,730.6798	0	-2,730.6798	0%	85.02%	-212.10%
43.71%	0%	-986.792			
2° Dev. Ch. ^e :	2° Dev. Ch.:	Net 2° Dev. Ch:	169.2927	19.1001	-150.1926
428.6774	4,381,9468	3,953.2694	23.41%	3.70%	72.57%
7.65%	74.49%	1,428.61%	169.2927	458.0623	288.7696
			23.41%	88.72%	-139.53%
Total Dev. Ch.:	Total Dev. Ch.:	Net Dev. Ch:			
3,159.3572	4,381.9468	1,222.5896	539.8990	0	-539.8990
56.35%	74.49%	441.81%	74.65%	0%	260.87%
1° Non-Dev. Change ^f :	1° Non-Dev. Change:	Net 1° Non- Dev. Ch.:	14.0680	58.2371	44.1691
0	1,076,5105	1,076,5105	1.94%	11.28%	-21.34%
0%	18.30%	389.02%	553.9670	58.2371	-495.7299
			76.59%	11.28%	239.53%
2° Non-Dev. Change ^g :	2° Non-Dev. Change:	Net 2° Non- Dev. Ch.:	723.2597	516.2994	-206.9603
2,446.8133	424.4353	-2,022.3780	100.00%	100.00%	100.00%
43.64%	7.21%	-730.83%			
Total Non-Dev. Change:	Total Non-Dev Change:	Net Non-Dev. Change:			
2,446.8133	1,500.9458	-945.8675			
43.64%	25.51%	-341.81%			
Total Ch. (Δ_1):	Total Ch. (Δ_2):	Net Total Ch. (Δ_3):			
5,606.1705	5,882.8926	276.7221			
100.00%	100.00%	100.00%			

Table 2 (continued)

Acres Changed from Ag. to other Categs. (Δ_1) & percent Gross Change ^d	Acres Changed from Other Categs. to Ag (Δ_2) & percent Gross Change ^b	Net Change in Cat. Acres $\Delta_2 - \Delta_1$ (Δ_3) & percent Net Change ^c	Acres Changed from Ag. to other Categs. (Δ_1) & percent Gross Change ^a	Acres Changed from Other Categs. to Ag (Δ_2) & percent Gross Change ^b	Net Change in Cat. Acres $\Delta_2 - \Delta_1$ (Δ_3) & percent Net Change ^c
- Orchards ("O") - ^g			- Pastures & Fields ("P") - ^h		
$\frac{1.1938}{2.50\%}$ -- --	$\frac{0}{0\%}$ -- --	$\frac{-1.1938}{-17.29\%}$ --	$\frac{232.4057}{23.59\%}$ -- --	$\frac{0}{0\%}$ -- --	$\frac{-232.4057}{-17.53\%}$ -- --
$\frac{0}{0\%}$ -- --	$\frac{.7805}{1.43\%}$ -- --	$\frac{.7805}{11.30\%}$ --	$\frac{5.0045}{.51\%}$ -- --	$\frac{1,090.7985}{47.20\%}$ --	$\frac{1,085.7940}{81.89\%}$ -- --
$\frac{1.1938}{2.50\%}$ -- --	$\frac{.7805}{1.43\%}$ -- --	$\frac{-.4133}{-5.99\%}$ --	$\frac{237.4102}{24.10\%}$ -- --	$\frac{1,090.7985}{47.20\%}$ --	$\frac{853.3883}{64.36\%}$ -- --
$\frac{0}{0\%}$ -- --	$\frac{0}{0\%}$ -- --	$\frac{0}{0\%}$ -- --	$\frac{0}{0\%}$ -- --	$\frac{122.0202}{5.28\%}$ --	$\frac{122.0202}{9.20\%}$ -- --
$\frac{46.4830}{97.50\%}$ -- --	$\frac{53.8016}{98.57\%}$ -- --	$\frac{7.3186}{105.93\%}$ --	$\frac{747.6307}{75.90\%}$ -- --	$\frac{1,098.1544}{47.52\%}$ --	$\frac{350.5237}{26.44\%}$ -- --
$\frac{46.4830}{97.50\%}$ -- --	$\frac{53.8016}{98.57\%}$ -- --	$\frac{7.3186}{105.99\%}$ --	$\frac{747.6307}{75.90\%}$ -- --	$\frac{1,220.1746}{52.80\%}$ --	$\frac{472.5439}{35.64\%}$ -- --
$\frac{47.6768}{100.00\%}$ -- --	$\frac{54.5821}{100.00\%}$ -- --	$\frac{6.9053}{100.00\%}$ --	$\frac{985.0409}{100.00\%}$ -- --	$\frac{2,310.9731}{100.00\%}$ --	$\frac{1,325.9322}{100.00\%}$ -- --

Table 2 (continued)

^aCategory's total Δ_1 used as percentage base.

^bCategory's total Δ_2 used as percentage base.

^cCategory's total Δ_3 used as percentage base.

^d"1° Dev. Ch." = primary development change (see text for definition).

^e"2° Dev. Ch." = secondary development change (see text for definition).

^f"1° Non-Dev. Ch." = primary non-development change (see text for definition).

^g"2° Non-Dev. Ch." = secondary non-development change (see text for definition).

^hValues organized according to the scheme established for "A".

classification, together resulting in about one-fourth of the total cropland gain.

The net change analysis clearly demonstrates the compensatory transformation factors at work. All of the primary and secondary figures had values above one thousand acres. However, resulting total net change was relatively small (+277 acres). The greatest net component gain was the +3,953 acres of secondary developmental change, whereas a large (-2,731 acres) net primary developmental loss contributed to the offsetting to that gain. Negative and positive factors were also at work in the non-developmental transformations.

Confined Animal Facilities

The overwhelming factor in the confined animal category's gross loss was the portion composed of primary non-developmental change (75 percent). Even more striking was the primary developmental change percentage (85 percent) of the total gross gain. These two elements worked against each other in the net change analysis, however. The result was a relatively modest (-207 acres) net loss in the confined animal category.

Orchards

The orchards category is a relatively subordinate classification, compared to the other singular agricultural categories. Furthermore, the entire change analyses were almost completely concerned with secondary non-developmental changes. The gross loss (46 acres), subtracted from the gross gain (53 acres), resulted in a net gain of 7 acres, which, in turn, comprised the bulk of the overall net change calculation.

Pastures

Pastures' gross loss included two significant components. Secondary non-developmental change accounted for 76 percent of the gross loss, while primary developmental change totaled 24 percent of this figure. The gross gain values demonstrated two closely corresponding figures - 47 percent of secondary developmental change and 48 percent for secondary non-developmental change. This also resulted in a fairly even split between overall developmental and non-developmental transformations.

The net change analysis illustrated the most significant absolute net change of any of the four agricultural categories. The +1,326 acres were the result of fairly large positive components values for all but the net primary development change figure (having -232 acres). Clearly the greatest factor was the 1,086 acres coming from net secondary developmental change.

Table 3
Compilation of Agricultural Change Totals.

Acres Changed from Ag to other Categs. (Δ_1) & percent Gross Change ^a	Acres Changed from Other Categs. to Ag (Δ_2) & percent Gross Change ^b	Net Change in Cat. Acres $\Delta_2 - \Delta_1$ (Δ_3) & percent Net Change ^c
- Gross Totals - ^d		
$\frac{2,964.2793}{40.26\%} \text{ ---}$	$\frac{438.9622}{5.01\%} \text{ ---}$	$\frac{-2,525.3171}{-180.05\%} \text{ ---}$
$\frac{602.9746}{8.19\%} \text{ ---}$	$\frac{5,492.6259}{62.67\%} \text{ ---}$	$\frac{4,889.6513}{348.61\%} \text{ ---}$
$\frac{3,567.2539}{48.45\%} \text{ ---}$	$\frac{5,931.5881}{67.68\%} \text{ ---}$	$\frac{2,364.3342}{168.57\%} \text{ ---}$
$\frac{539.8990}{7.33\%} \text{ ---}$	$\frac{1,198.5307}{13.67\%} \text{ ---}$	$\frac{658.6317}{46.96\%} \text{ ---}$
$\frac{3,254.9950}{44.21\%} \text{ ---}$	$\frac{1,634.6284}{18.65\%} \text{ ---}$	$\frac{-1,620.3666}{-115.53\%} \text{ ---}$
$\frac{3,794.8940}{51.55\%} \text{ ---}$	$\frac{2,833.1591}{32.32\%} \text{ ---}$	$\frac{-961.7349}{-68.57\%} \text{ ---}$
$\frac{7,362.1479}{100.00\%} \text{ ---}$	$\frac{8,764.7472}{100.00\%} \text{ ---}$	$\frac{1,402.5993}{100.00\%} \text{ ---}$

^aCategory's total Δ_1 used as percentage base.

^bCategory's total Δ_2 used as percentage base.

^cCategory's total Δ used as percentage base.

^dValues organized according to the scheme established in Table 2.

^eNet totals = "gross totals" minus "shift among agricultural categories" figures.

Table 3 (continued)

Acres Changed from Ag to other Categs. (Δ_1) & percent Gross Change ^a	Acres Changed from Other Categs. to Ag (Δ_2) & percent Gross Change ^b	Net Change in Cat. Acres $\Delta_2 - \Delta_1$ (Δ_3) & percent Net Change ^c
- Shift Among Agricultural Categories - ^e		
$\frac{320.3856}{14.08\%}$ ---	$\frac{320.3856}{14.08\%}$ ---	$\frac{0}{0\%}$ ---
$\frac{0}{0\%}$ ---	$\frac{0}{0\%}$ ---	$\frac{0}{0\%}$ ---
$\frac{320.3856}{14.08\%}$ ---	$\frac{320.3856}{14.08\%}$ ---	$\frac{0}{0\%}$ ---
$\frac{437.3003}{19.22\%}$ ---	$\frac{437.3003}{19.22\%}$ ---	$\frac{0}{0\%}$ ---
$\frac{1,517.4655}{66.70\%}$ ---	$\frac{1,517.4655}{66.70\%}$ ---	$\frac{0}{0\%}$ ---
$\frac{1,954.7658}{85.92\%}$ ---	$\frac{1,954.7658}{85.92\%}$ ---	$\frac{0}{0\%}$ ---
$\frac{2,275.1514}{100.00\%}$ ---	$\frac{2,275.1514}{100.00\%}$ ---	$\frac{0}{0\%}$ ---
- Net Totals - ^{d,e}		
$\frac{2,643.8937}{51.97\%}$ ---	$\frac{118.5766}{1.83\%}$ ---	$\frac{-2,525.3171}{-180.05\%}$ ---
$\frac{602.9746}{11.85\%}$ ---	$\frac{5,492.6259}{84.64\%}$ ---	$\frac{4,889.6513}{348.61\%}$ ---
$\frac{3,246.8683}{63.83\%}$ ---	$\frac{5,611.2025}{86.46\%}$ ---	$\frac{2,364.3362}{168.57\%}$ ---
$\frac{102.5987}{2.02\%}$ ---	$\frac{761.2304}{11.73\%}$ ---	$\frac{658.6317}{46.96\%}$ ---
$\frac{1,737.5295}{34.16\%}$ ---	$\frac{117.1629}{1.81\%}$ ---	$\frac{-1,620.3666}{-115.53\%}$ ---
$\frac{1,840.1282}{36.17\%}$ ---	$\frac{878.3933}{13.34\%}$ ---	$\frac{-961.7349}{-68.57\%}$ ---
$\frac{5,086.9965}{100.00\%}$ ---	$\frac{6,489.5958}{100.00\%}$ ---	$\frac{1,402.5993}{100.00\%}$ ---

Gross Totals

The section of Table 3 classified as "Gross totals" depicts the summation of all of the foregoing subtotals. As is shown in this analysis, the gross loss values were evenly split between developmental and non-developmental changes. However, within those two groups, there is a clear dominance by two elements - secondary non-developmental change (44 percent of the gross loss) and primary developmental change (40 percent of the total).

The gross gain analysis showed somewhat different results. Roughly two-thirds of the total gross gain in agriculture was due to a developmental change, with one-third comprising the non-developmental factor. The most substantial discrete change occurred in the secondary developmental change element, where 63 percent of the total gain existed. The non-developmental results showed an approximate two-to-one ratio of secondary to primary change.

The net change values do not change after consideration of intra-agricultural shifts (see next section), and will, therefore, be discussed in the subsequent "Net totals" analysis.

Shift Among Agricultural Categories

To calibrate the final agricultural figures, it is important to consider the oscillations between the four categories under study. This not only tempers the results so that agricultural-versus-other category comparisons can be more validly conducted, but also quantifies a phenomenon that would otherwise not be clearly discernible.

As shown in the "Shift among agricultural categories" section of Table 3, gross totals are always compensatory within each category, due to the nature of the tabulation. However, it is interesting to note the large portion (86 percent) of the total intra-agricultural flux devoted to non-developmental change. Moreover, fully two-thirds of the total change was composed of secondary non-developmental change. A fairly large value (2,275 acres) made up the total figure for these computations. This is roughly thirty-one percent of the total gross loss and approximately twenty-six percent of the total gross gain figures.

Net Totals

After subtracting out the intra-agricultural shifts, net totals for Table 3 were calculated and illustrated in the appropriately labeled section. Due to the modification of some of the transformations after considering intra-agricultural shifts, the gross loss and gross gain values differed from those of the "gross totals." This time, there was a substantial disparity between developmental and non-developmental gross losses, with 64 percent of the total change comprising the former, and only 36 percent comprising the latter. The component values also shifted. Primary developmental change now increased to 52 percent, while secondary non-developmental change decreased to 34 percent.

The gross gain values also experienced similar changes. The development to non-development ratio became 86 percent to 14 percent. Secondary developmental change increased significantly to 85 percent, while secondary non-developmental change decreased substantially to two percent.

As mentioned previously, the net change analysis did not change from the gross evaluation, due to the overall compensatory nature of the intra-agricultural dynamics. The overall net developmental change (+2,364 acres) was about 2.5 times as large, in absolute terms, as the net non-developmental change (-962 acres). Forming the net developmental change were -2,525 acres of primary change and +4,890 acres of secondary change. Making up the net non-developmental change were +659 acres of primary change and -1,620 acres of secondary change. The overall net change was computed to be +1,403 acres.

Summary and Conclusions

Overall, it was concluded that the study approach proved to be systematic, productive, and quite accurate, but was also found to be extremely laborious and time-consuming. The offsetting nature of the shifting agricultural categories is now easily deciphered - a phenomena that could not be appreciated if the study analyzed and compared only yearly total and net differences obtained from static time-series maps or statistical records, as more typically cited in the literature.

Results showed that the study area's greatest agricultural component was cropland. As demonstrated, a great portion (over twenty-five percent) of the gross farmland change was due to intra-agricultural transformations alone. The overall net increase in the four combined singular agricultural categories was also made up of positive and negative components. The largest of these - almost five thousand additional acres in secondary developmental change - worked to dominate the complexion the the net farmland change. This component transformation demonstrated that, in the final analysis, the majority of the change involving agricultural land resulted from more passive land uses becoming less passive agricultural tracts. This is indicative of the study region's economic dependence on agriculture - specifically, the broiler industry. As this thriving sector continually expands, greater demand is placed upon marginal farmlands and more passive non-farm lands to enter into more productive uses. By clearing previously wooded or "open space" tracts and by artificially draining high water table soils through an extensive drainage ditch network area farmers have successfully produced the grain crops (i.e., corn and soybeans) necessary to accommodate the ever-expanding broiler industry's needs. A further significant finding was the loss of farmland to more developmental-type uses.

It can be safely stated from the foregoing results that most of the changes in the study region involved developmental transformations. This agrees with the finding of this study's parent research project, which demonstrated that, typically, more intensive developmental land use displaced more passive agricultural and natural-resource land classes during the nineteen year study period. Most of the 1954 shifting acreages gave way to typical recreational/resort-oriented land uses by 1973, e.g., fixed and mobile

residences, transitional idle land, and commercial establishments. This was basically due to the infrastructural demands placed upon the area by the seasonal residents.

Net agricultural changes demonstrated both positive and negative factors, but, ultimately showed a growth due to developmental changes - mostly secondary. While masking an extremely dynamic situation, the overall net increase of roughly 1,400 acres still coincides with the phenomenon cited in the literature and discussed previously. To wit, it documents that, although the agricultural sector demonstrated developmental and non-developmental shifts, both within and outside its own land uses, farming unmistakably survived the pressures that existed in the study region between 1954 and 1973, emphasizing its importance to the study region's economy and character.

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