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A Computer Modeling Technique for Analyzing the Socio-Political Inputs for Land-Use Planning in a Coastal Zone*

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Background

The Coastal Zone Management Act of 1972 was designed "to establish a comprehensive national program for the management, beneficial use, protection and development of the nation's coastal zones."¹ The national government committed itself to short-term subsidy (up to two-thirds of the cost for up to two years) for coastal states while they developed a coastal zone management plan. Subsequent to a state's adoption of a plan and the Secretary of the Interior's approval of it, he could approve grants to the state to a maximum of one-half of the cost of acquiring estuarine sanctuaries to be used for research purposes. The Secretary was to have an Advisory Committee for Coastal Zone Management and was to review state programs and performances. Thus, states were given an important role in coastal zone management, but ultimate sanction was left to the national government.

The state of South Carolina has a coastal zone comprised of a thriving recreation and tourism industry at Myrtle Beach on the northern coast and Hilton Head Island on the southern coast, with the ports of Georgetown and Charleston between, and with the Cape Romain Migratory Bird Refuge (the coastal extension of the Francis Marion National Forest) between the two ports. Coastal waters consist of the purest estuary remaining on the east coast as well as waters terribly polluted by paper mills and heavy industry. The inordinate unevenness of water quality has led to increasingly numerous and bitter conflicts between those who want to promote the recreation industry and those who prefer industrialization. Those preferring industrial development face the pressure to clean up existing polluted water bodies while at the same time they demand some degree of reduction of water quality in the pristine areas. However, they insist that industrial development would not reduce the present SA water classification where it exists. They contend that industrial development is needed to provide jobs and to raise the relatively

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¹Subtitle of HR 14146, 92nd Congress.

poor economic status of South Carolina. Those preferring the recreation industry contend that Horry and Beaufort counties (Myrtle Beach and Hilton Head Island respectively) are among the top per capita income counties in the state.

We proposed A STRUCTURAL-FUNCTIONAL ANALYSIS OF THE SOCIO-POLITICAL SYSTEM RELATIVE TO WATER AND RELATED LAND RESOURCES IN THE COASTAL ZONE OF SOUTH CAROLINA, which coincided with the passage of the Coastal Zone Management Act of 1972. It was jointly funded by the then Office of Water Resources Research in the Department of the Interior, and by the Water Resources Research Institute at Clemson University. It involved a structural-functional analysis of the socio-political system of each of the seven coastal counties for the purpose of developing an additional input system for those decision makers concerned with the coastal zone. We hoped to develop a model which could be used by County Development Commissions, State Development Boards, Coastal Plains Regional Commissions, Army Corps of Engineers, Water Resources Commissions, as well as any other agencies which cared to use it.

In order to collect data on the socio-political forces operating in the arena of land-use planning in the seven coastal counties of South Carolina, the numerous active and latent political interest groups, as well as the various governmental units and agencies with jurisdiction over parts of the coastal zone, had to be identified. While we have defined the coastal zone to include seven counties (Horry, Georgetown, Berkeley, Charleston, Colleton, Beaufort, and Jasper), approximately 95% of South Carolina's Atlantic shoreline is within the four counties of Horry, Georgetown, Charleston, and Beaufort. There are almost 498,000 people residing in these seven coastal counties, but more than 402,000 of them live in Horry, Georgetown, Charleston, and Beaufort counties. Horry and Beaufort counties depend heavily on recreation and tourism related to the ocean and beaches as a large part of their economy. Charleston county also depends heavily on recreation and tourism, but related more to the historical value of the city of Charleston than to the ocean and beaches. Consequently, it is not surprising that most of the interest group activity related to land use planning for the coastal zone is centered in Horry, Georgetown, Charleston, and Beaufort counties.

The seven counties comprising the coastal zone collectively are within the jurisdiction of three Regional Councils of Government. The area of responsibility of the Waccamaw Regional Planning and Development Council includes Georgetown and Horry counties; the Berkeley-Charleston-Dorchester Regional Planning Council's area of responsibility includes Berkeley and Charleston counties; and the jurisdiction of the Lowcountry Regional Planning Council includes Colleton, Beaufort, and Jasper counties. These three regional councils of government, which are headquartered in Georgetown,

S. C., Charleston, S. C., and Yemassee, S. C. respectively, were one starting point in our effort to identify the numerous private interest groups and governmental units and agencies that might make relevant inputs into the land-use planning process for the coastal zone.

Each of the four principal counties on which we focused also has an agency, usually known as a County Development Commission, whose responsibility it is to promote the economic well-being of the county, principally by attracting desirable new business ventures into the county of the Commission's jurisdiction. These Commissions were also extremely helpful starting points for the identification of the relevant actors in the arena of land-use planning for our study area.

By beginning our research effort with visits to these two types of agencies, we were able to obtain fairly comprehensive lists of the public and private actors which were likely to make inputs into water resources and land-use planning. Typically included were such governmental agencies and units as mayors' offices, county councils, water and sewer districts, local and county planning boards, and Army Corps of Engineers districts.

The nature of the private interest groups uncovered by this effort spanned a range of several types. Civic organizations such as a local chapter of the League of Women Voters, the Preservation Society of Charleston, or a local Chamber of Commerce have interest in land-use and water resources, if at all, only as a relatively minor part of their general commitment to their conception of community development, government, and "the good society." Small neighborhood or community based organizations, typically taking the form of a property-owners or land-owners association tend to focus narrowly on the maintenance and enhancement of the monetary and esthetic value of their holdings, rather than on a broad commitment to sound environmental quality and planning for a larger interdependent region. Because of their narrow geographic focus, however, this type of private interest group may be very influential with respect to developmental decisions directly affecting their own community. A third major category comprises local affiliates of state, regional, or national organizations committed to environmental, land-use, or water-resources related issues. Audubon, Sierra Club, Ducks Unlimited, and the South Carolina Environmental Coalition would be representative of this type. A fourth group is the *ad hoc* organization which comes into being as a result of a specific environmental, land-use, or water-resource related issue facing a town or county. This type may disband after the issue over which it coalesced is resolved, but it often continues to grow into a more general purpose interest group concerned about environmental issues. Included in this category would be organizations such as Environmental Action, Inc. (Georgetown) and South Carolina Environmental Action, Inc. (Hilton Head Island). A final category of private interest group includes the opinion leaders

of the various communities we surveyed. Within this category would be the local newspapers found in each of the counties involved in our study, which often took editorial positions on issues affecting county development and hence environmental quality. Also included herein would be certain prominent citizens and "experts" whose views are important apart from whether or not they are formally affiliated with any of the aforementioned types of private interest groups. Examples of this latter type might range from powerful political figures like Jim Moore of Georgetown County, to academic experts like Bruce Ezell and Richard Porcher at The Citadel in Charleston, S. C.

With these initial lists of private interest groups and of governmental units and agencies with jurisdiction over the coastal zone, we were able to begin the first stages of our research. We did not assume, of course, that these initially identified interest groups and governmental units exhausted the possibilities. Hence, whenever we contacted an individual or group on our initial list, we always asked for names of individuals, organizations, and governmental agencies that we should contact with respect to our research. In addition, by keeping careful watch over the local newspapers, we were also able to identify newly developing issues and potential controversies related to the subject matter of our study, as well as to identify new political actors brought into the arena of land-use planning. In this fashion, we believe we have been successful in identifying all the major actors involved in land-use planning for the coastal zone of South Carolina.

We determined that the information needed from each identifiable group included:

- socio-economic composition; i.e., size, relative power, the base of or reason for that power, skill (leadership, experience, etc.), resources available, and cohesion.

- jurisdiction.

- goals and objectives.

- past record, indicating the group's activity and/or inactivity.

- the group's opinion of other groups and/or agencies (to indicate potential conflict or cooperation, and also to cross check each group's self-assessment).

- which government agencies were regarded by the group as most and least friendly, and with which agencies the group had most and least frequent contacts.

- type of development it would most and least like to see.

- locations in which the group would most and least like to see economic development within its jurisdiction.

Information needed about governments included:

- identification of the governmental agencies or units which were di-

rectly concerned with or active in pursuit of economic development within each county.

— the other governmental agencies or units with which each of the above were most interactive and the nature of that interaction.

— the interest groups with which each governmental agency or unit was most interactive and the nature of that interaction (i.e., clientele relationships).

— the extent and nature of intergovernmental relationships between local, state, and national levels of government, overlapping jurisdictions, and history of cooperation or conflict.

— type of development it would most and least like to see.

— locations in which the agency or unit would most and least like to see economic development within its jurisdiction.

The last two types of information were sought at the end of each interview. The questionnaire used to discover this information is portrayed in Figure 1. The "Geographic Area" was left blank so each respondent could divide the county as it made sense to him. The most obvious "misgrouping" might seem to be the second one because of the dissimilarities among the industries included, but the rationale for it was that all of these industries are consumers of large quantities of water. This grouping drew some comments from respondents, but caused no serious problems once the rationale was explained.

FIGURE 1

	GEOGRAPHIC AREA				
1 = STRONGLY DISAPPROVE 2 = DISAPPROVE 3 = NO OPINION 4 = APPROVE 5 = STRONGLY APPROVE					
Chemicals, rubber, plastics & allied products; Petroleum & related products; Leather processing; Primary metals industries					
Power plants & other utilities; Wood, paper & allied products; textile mills; Food & kindred products					
Apparel manufacture; Leather products finishing; Miscellaneous light manufacturing; Printing, publishing, and allied industries; Furniture manufacturing					
Fabricated metal products (including machinery, electronic equipment, transportation equipment, etc.); Stone, clay, glass & concrete					
Trucking & warehousing; other commercial development					
Tourism, recreation, retirement community					
Military base					
Logging					

Once the data had been collected, the substantial problem of organizing and placing them in a form that could be available and understood by all interested publics still remained. The use of a computer to condense a great mass of data into a comprehensible and useful format appeared to be the optimal solution. Terry W. Keyes, then a graduate student in Environmental Systems Engineering at Clemson University, employed his knowledge of computer programming to assist in the development of the two programs we use in our model for analyzing the socio-political inputs for land-use planning in South Carolina's coastal zone. Both programs are written in the FORTRAN language, and the computer employed was the IBM 370/158 at Clemson University. One program relates to the data collected with regard to the private interest groups, and the second program organizes the data collected about the governmental units and agencies.

Interest Group Program

The inputs to this computer program originate from two sources. First, the numerical values assigned by respondents on the questionnaires are used directly as measures of their intensity of feeling towards the prospect of a particular type of industry or development being sited at various locations in the geographic area of concern to them. Since we usually had questionnaires from more than one member of each interest group, the responses indicated on the several questionnaires for each group were averaged, and the mean was employed as the measure of the group's intensity of feeling. Second, the data compiled by our semi-structured interviews with representatives of the interest groups yielded indexes of three socio-political factors relevant to establishing the group's influence and power.²

The *resources* available to a group refers to the various tangible and intangible assets of a group that can be put to political use when and if that group chooses to act in a political struggle. While the most obvious of these resources is money, and while financial resources are of great significance in political struggles, it is not the only one to be considered. A group's social prestige or its legitimacy, for example, affects the probabilities of its winning a successful resolution of political issues being debated in the political arena. A local newspaper may not actually spend money to promote its editorial position on a land-use issue, but its ability to use its columns to promote its own views and thereby to seek to influence its readers, is obviously a very valuable resource. Taking these and other similar factors into consideration, we assigned values of zero, one, or two to the resources available to each of the interest groups identified in our study, with the higher values denoting greater resources.

²We rely here on the substantial body of political science literature which deals with the sources of an interest group's power. See, for example, David B. Truman, *The Governmental Process* (New York: Alfred A. Knopf, 1951), and V. O. Key, Jr., *Politics, Parties, and Pressure Groups*, 5th edition (New York: Thomas Y. Crowell Company, 1964), which are two leading representatives of this tradition.

The *skills* possessed by each of the interest groups is also a critical factor in assessing its ability to influence decisions made in the political arena. In the course of our semi-structured interviews with the leaders of the interest groups, we elicited information as to hypothetical strategies that the group would pursue in seeking to influence a land-use decision. Or if the group was one that had been in existence for an extended period of time, we asked about the techniques the group had employed with respect to earlier similar issues. On the basis of this kind of information, we developed an index of each group's political skills which could take on the values zero, one, or two. Thus, for example, a group whose membership included several lawyers who were familiar with the system of public hearings and Environmental Impact Statements required by the Army Corps of Engineers or the National Environmental Policy Act, and who knew how to exploit that system for successfully achieving the group's goals would receive the highest rating on our index of skills.

The final factor which had to be indexed so as to become an input for our interest group program was the *intensity* of the group's concern with land-use decisions directly affecting each of the geographic sub-areas which the respondents themselves had identified when completing the questionnaire. Unlike the cases of our measures of skills and resources, which are assigned constant values for each group, it appeared that we had to account in some way for variations in how hard a group would be willing to fight to influence land-use decisions more or less directly influencing their main geographic base. For example, the Litchfield Beaches Property Owners' Association might be willing to dedicate all the resources and skills in its possession in order to prevent, say, an offshore oil storage facility from being built in close proximity to the holdings of its members. Yet, the same group might be unwilling to intervene at all in, say, a debate as to whether another paper mill should be permitted to locate in Georgetown, some 12 miles down the road from Litchfield Beach. Again, the semi-structured interview yielded the data necessary to assess this factor, and we therefore assigned values of zero, one, two, or three to the intensity of the group's concern with the outcome of land-use decisions for *each* of the geographic sub-areas which respondents identified on their questionnaires. The higher the assigned value, the more likely it is that the group will seek to intervene in a land-use decision affecting the given area.

These four variables (opposition to or agreement with the siting of a type of industry or development at a particular location; the group's resources; the group's skills; and the group's intensity of concern with outcomes in each geographic sub-area) formed the major input for our interest group program. The variables are combined to yield a single number which we have tentatively labeled the "power index." This factor may take on any value between

+4 and -4, with the positive sign meaning support for, and the negative signifying opposition to, the location of a certain type of industry or development in a given geographic area. The absolute value of the "power index" indicates the magnitude of the group's influence over a decision about a particular type of industry locating in a specific area, should a conflict arise. The larger the absolute value of the "power index," the more influential the group is likely to be. For example, if Environmental Action Inc. of Georgetown has a "power index" of -4 on the question of a petrochemical plant being sited within the city limits of Georgetown, South Carolina, the interpretation of the number (-4), is that the group will strongly oppose that prospect and that it possesses the skills and resources to exert a great deal of political pressure in attempting to prevent the industry from locating in Georgetown.

The "power index" is computed by combining the values assigned to each group on each of the four variables discussed above according to the following equation:

$$\text{POWER INDEX} = \frac{(\text{SKILL} + \text{RESOURCES}) \times \text{INTENSITY} \times (\text{REACTION} - 3)}{6}$$

Resources and skill are added because their combination provides a more accurate indicator of the group's potential influence than either factor would standing alone. Multiplication of that sum by the value assigned to the group's intensity of concern accounts for the probability that the group will employ its potential influence in a given set of circumstances. Multiplication by the term (Reaction - 3) has the effect of including in the "power index" a measure of whether the given group will oppose or support a particular land use as well as a measure of how strongly it feels about the projected land use. The product of the two successive multiplications is then divided by six simply to reduce the magnitude of the resulting numbers, and thus, the equation yields a range for the "power index" of +4 to -4.

The output from our program is printed in sections by the computer. Each section represents a certain category of industry in a certain geographic sub-area of one of the seven counties we studied. Each of the sections is identified as to the county, sub-area, and type of industry that it deals with. Then, each political interest group which indicated that geographic sub-area on its questionnaires will be named, as will its reaction number to the given type of industry, its resource index, its skill index, and its intensity of concern index for the given sub-area. Finally, the printout will also display the "power index" for the interest group in the given case.

The printout also produces, for each section, the sum of all the positive values of the "power index" and the sum of all the negative values. The mean

and standard deviation of the values of the "power index" numbers are also shown. For example, "power index" sums of +20 and -20 for a certain type of industry in the given geographic sub-area indicate that there is an equality of potential influence among the groups opposed to and supportive of the specified land-use. However, the relatively high magnitudes of these sums indicate a large potential for political conflict to develop in the given situation. The mean value of the "power index" provides an indication of the combined reaction of all concerned interest groups to the given situation. (Groups with a "power index" equal to zero are omitted from this calculation since they are apathetic towards any outcome in the given situation.) Thus, for example, a mean value of -4 would signify that *all* groups having any interest in the given situation intensely oppose the hypothetical land use. Finally, the standard deviation, which ranges from 0.0 to 5.66 in the data we have analyzed, provides an indication of the extent of agreement or disagreement among concerned interest groups about the desirable outcome of a land-use conflict. Values of the standard deviation which are less than one indicate broad consensus among all groups concerned; values between one and two indicate moderate disagreement, and hence a moderate potential for political conflict; and values greater than two indicate great disagreement and a high potential for political conflict to develop over the projected land-use.

Governmental Unit or Agency Program

The information we collected with regard to the various governmental units and agencies operating in the seven coastal counties posed somewhat different problems for data analysis than those discussed in the preceding section. Use of the "power index" to evaluate and compare different public sector actors did not seem appropriate since its constituent variables (especially resources, skills, and intensity of concern) do not have significant meaning here. Since the governmental units and agencies in question typically have *de jure* and/or *de facto* legal and political responsibility for land-use planning in the coastal zone, assigning values for intensity of concern would have little real meaning. Similarly, trying to differentiate between different degrees of skills and resources possessed by several elected and appointed public officials, appears equally inappropriate. Finally, even if we could deal with the above difficulties, we would still be left with the virtually irresolvable problem of the comparability, or lack of it, between the values assigned to public sector actors and those assigned to the interest groups.

The solution we employed to resolve these difficulties was a simple one, which we have labeled the "unity index." Essentially what this program does is to evaluate the mean and standard deviation of the reactions the various political actors indicated on their questionnaires to the prospect of a particular type of industry or development locating in each of the sub-areas of concern.

These two statistics are useful because the mean provides information as to the consensus of political actors' opinions about a certain industry locating in a given area, while the standard deviation provides information as to how scattered or uniform that consensus of opinion is.

The range of values that can be taken on by the mean varies from *one* to *five*, with *one* indicating strong disapproval towards a particular type of industry locating in a particular area, and *five* indicating strong approval for such a situation. The standard deviation on the samples run varies over a range of from zero to just less than three. A standard deviation of zero, of course, indicates a situation in which all respondents to the questionnaire chose precisely the same value to express their reaction. Standard deviations greater than zero but less than one indicate very similar reactions by most public officials. Values greater than one but less than 1.75 reveal a moderate amount of disagreement by public officials as to the given projected land use. Finally, values for the standard deviation greater than 1.75 indicate great disagreement among actors in the political sector as to a given industry locating in the given area.

Conclusion

The results obtained from our model will be useful to the land-use decision-maker in a variety of ways. First, in considering the possibility of siting a particular type of industry in a given area, our findings will enable him to anticipate probable reactions to the development by a variety of public and private sector political actors. Thus opposition can be anticipated, and this creates the likelihood that more effective solutions can be worked out, rather than the situation deteriorating into a protracted, bitter, and divisive BASF-type struggle. Second, if the land use planner is interested in a particular type of industry, say a power plant, our model will readily yield information as to specific locations where opposition to that type of industry will be lowest, and where support for it will be highest. Third, if the planner is concerned with attracting any sort of industry to a specific geographic location, our model will yield data as to the types of industry that would be most welcomed and those that would be most opposed by the private and public sector political actors concerned with that location. Finally, our model will be useful to planners, political officials, and interested publics in providing indications as to areas of agreement and disagreement between public officials and interested publics about acceptable uses for given areas. In this way, public officials will be in a better position to represent and/or to educate their constituents as to land-use planning.

Our model is sufficiently general that it also should be adaptable, with little or no modification, to the evaluation of the socio-political inputs affecting land-use decisions in a variety of other geographic regions, which need not

necessarily be coastal zones. Finally, we should state one caution. We do not anticipate, nor do we desire, that the outputs generated by our model should be the sole, or even the principal, determinant of public policy with respect to land-use planning. Obviously, the insights of biologists, hydrologists, zoologists, botanists, and other such specialists are also desirable. So too are the views of promoters of economic growth and development and the fervent environmentalists. What we hope our model achieves, therefore, is an additional input for the land-use decision-making arena, focusing on the legitimate concerns of interested publics and public officials.