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STUDY TITLE: Ecological Characterization of the Mississippi Delta Plain Region

REPORT TITLE: An Introduction to the Environmental Literature of the Mississippi Deltaic Plain Region

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BACKGROUND: The Mississippi Deltaic Plain Region is an extremely productive fishery and wildlife area. The U.S. Department of the Interior was interested in evaluating the environmental deterioration of this region, particularly due to oil and gas activities, and initiated an environmental literature search and synthesis study of the Mississippi Deltaic Plain Region.

OBJECTIVE: To review the state of knowledge concerning the functional relationships governing environmental characteristics and changes of the Mississippi Deltaic Plain Region.

DESCRIPTION: This study involved a systematic review of the information base concerning the major physical and biological processes that govern the ecological structure of the Mississippi Deltaic Plain Region and the effects on oil and gas activities.

SIGNIFICANT CONCLUSIONS: Geomorphic aspects of the Mississippi Deltaic Plain Region are known in general terms; future research, employing more precise methods, should focus on more detailed elements of the system. Site-specific studies and long-term regional monitoring of hydrological effects on habitat characteristics should be

conducted. More research is needed on particular atmospheric conditions, such as insolation and evapotranspiration; observations of meteorological data; environmental responses to weather events; land-sea breeze phenomena; climatic variation and regional ecological adjustments; and inversion layers across the coastal zone. Important topics for future research also include native and exotic plant ecology, extent and composition of wetlands habitats, establishment of workable management schemes, and evaluation and mitigation of man-induced habitat alterations. Fishery research should emphasize early life history of commercially important species and quantitative aspects of consumer communities which would allow development of sound management plans. General ecological information is not available for many nongame birds, small mammals, and herpetofauna, thus the functional role of these species in the ecosystem is not known. Future ecological investigations should further consider functional (e.g., energy conversion, nutrient cycling, primary productivity) and structural (i.e., species composition, abundance, and distribution) aspects of particular communities. Impacts from oil and gas activities are the most significant man-induced disturbances.

STUDY RESULTS: The Mississippi Deltaic Plain Region is composed of two physiographic subregions: the Mississippi River Deltaic Plain of southeastern Louisiana, and the estuary-lagoon system of Mississippi. Sediments (silts, clays, sand, and organic and inorganic matter) interact with moving water to form fluvial, paludal, fluvial-marine, and marine geomorphic forms. In the estuary-lagoon system, depositional environments include offshore barrier islands, Mississippi Sound, major semi-enclosed estuaries, and river estuaries. Water movement includes river migration, tidal fluxes, alongshore currents, and storm surges. Surface motion is the result of local subsidence through sediment loading and tectonic activity.

The Mississippi Deltaic Plain Region waters are divided into four components or subsystems, based on geomorphology and hydrology: rivers, uplands, lower basin, and nearshore Gulf. Forcing mechanisms of the hydrological regime are riverain, atmospheric, marine, and socioeconomic (e.g., waste water discharges). Inflow measurements and sediment loads of freshwater from the Mississippi and Atchafalaya Rivers have been investigated. Atmospheric influences on hydrology include changes in water level, movement, temperature, and quality. Most studies have focused on atmospheric effects of surface water circulation, especially in deep waters. Numerous studies have been conducted on salinity and temperature stratification, surface circulation patterns, and tidal variations. Dredging and filling, water level management, and waste water discharge are often monitored; however, detailed evaluations are not available.

Air quality and meteorology were reviewed in three ecological divisions: nearshore waters, lower basin, and upper basin. Storms, particularly tropical cyclones, produce significant effects on water movements, water level changes, and water quality in nearshore and upper basin areas. General climatological information is available as statistical summaries of observed conditions and as analyses of observed data in some form other than recorded statistics. Air quality data summaries are published annually by the U.S. Environmental Protection Agency on suspended particulates, carbon

monoxide, nitrogen dioxide, total dioxide, total hydrocarbons, and total oxidants. Precipitation studies involved prediction of normal or storm-related precipitation, urban modification of precipitation and flooding, and excess precipitation potential. Temperature has received little attention in the literature, and solar radiation has not been investigated in the region. Evapotranspiration is affected by cloud cover, relative humidity, temperature, and wind speed. The importance of evapotransporation and solar insolation is not adequately known.

Three categories of biology are covered for the study region: botany, fisheries, and wildlife. Botanical studies, both pure and applied, have been completed pertaining to ecology and distribution of plant species and communities in terrestrial, wetlands, and aquatic habitats. Terrestrial environments include natural and artificial levees, spoil deposits, and reclaimed wetlands and barrier islands. Wetlands vegetation may be grouped into swamp, bottomland hardwoods, and marshes. Generally, plant communities have been well described and mapped, and relationships between species and environmental variables have been investigated. Recreational and commercial fisheries are dependent on freshwater and estuarine species of fishes, molluscs, and crustaceans. Estuarine habitats are most productive in terms of fishery species, and many marine species are dependent on these areas for nursery grounds. Wildlife includes mammals, birds, reptiles and amphibians, and terrestrial and wetlands invertebrates. Distribution and abundance of wildlife are related to habitat physiography. Present wildlife research efforts have been directed toward economically important game species (i.e., waterfowl) and include abundance, distribution, food habits, harvest, and general life history studies.

Primary productivity is contributed by floating and submerged aquatic vegetation, phytoplankton, benthic and epiphytic algae, emergent marsh grasses, arboreal swamp vegetation, and coastal plain pine forests. Fishery species comprise an appreciable portion of secondary production in the aquatic ecosystem. Wildlife also contributes to secondary production; the functional role of a particular species depends on utilization of aquatic, terrestrial, or wetlands habitats. Several reports on habitat utilization by birds, mammals, and snakes are available. Nutrient inputs are affected by agricultural practices and urban runoff, with most nutrients accumulating in swamps. Marshes tend to be regulators of nutrient cycling through variable decomposition of vegetation; most nitrogen input is from biological fixation and sedimentation. Information on marsh populations of biodegrading microbial and fungal populations is meager. Management of wetlands ecosystems has sought to improve timber, wildlife, and fishery production.

Significant environmental impacts caused by oil and gas activities have been reported. Wetlands destruction and fishery habitat loss have resulted from canalization, dredging, leveeing, silting, and erosion. Oil spills and discharges have adversely affected wildlife and fishery species. New technology and better cooperation between oil companies and environmental managers should reduce adverse and deleterious consequences of future oil and gas operations in the Mississippi Deltaic Plain Region.

STUDY PRODUCT: Van Beek, J. L., D. J. Davis, R. E. Emmer, S. A. Hsu, I. A. Mendelssohn, D. S. Sabins, C. L. Wax, and K. M. Wicker. 1981. An Introduction to the

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