U.S. Army Corps
of Engineers®

ECONOMICS OF THE SHORELINE

An Annotated Bibliography for the National Shoreline Management Study

IWR REPORT 04-NSMS-5

MARCH 2004

National Shoreline Management Study

The National Shoreline Management Study, authorized in the Water Resources Development Act of 1999 under Section 215c, presents an opportunity to examine the status of the Nation's shoreline for the first time in 30 years. Results from the study will provide a basis for Federal actions regarding shoreline management for the foreseeable future. The study will provide a technical basis and analytical information useful in developing recommendations regarding shoreline management, including a systems approach to sand management, and roles for Federal and non-Federal participation in shoreline management.

The study will:

- summarize information about shoreline changes (erosion and accretion) available from existing data sources and examine the causes and economic and environmental effects;
- identify and describe Federal, state and local government programs and resources related to shore restoration and nourishment; and,
- explore ideas concerning a systems approach to sand management.

The assessment of the nation's shorelines will take into account the regional diversity of geology, geomorphology, oceanography, ecology, commerce, and development patterns.

The study will be undertaken through collaborative efforts with other agencies. Information and products will be scoped, developed, and reviewed by national technical and policy committees involving multiple agencies. The National Study team will also solicit input from other interested parties and in developing study recommendations.

The U.S. Army Corps of Engineers' Institute for Water Resources (IWR) is managing the study working closely with the Engineer Research and Development Center (ERDC) Coastal and Hydraulics Laboratory and Corps field experts. National technical and policy committees, which include other agency experts, will be assembled as integral components of the study.

For further information on the National Shoreline Management Study, contact any of the following

Robert Brumbaugh, PhD
Study Manager
Institute for Water Resources
Casey Building
7701 Telegraph Road
Alexandria, VA 22315-3868
Telephone: (703) 428-7069
Robert.w.brumbaugh@usace.army.mil

Joan Pope
Technical Director
Coastal & Hydraulics Laboratory
Engineer Research and Development Center
3909 Halls Ferry Road
Vicksburg, MS 39180-6199
Telephone: (601) 634-3034

Janice Rasgus
Senior Policy Advisor
Planning & Policy Division
HQUSACE
441 G St., NW
Washington, DC 20314
Telephone: (202) 761-7674

Or go to the study website at: http://www.iwr.usace.army.mil/NSMS. The website provides reports to date and study progress along with topical links to other related studies and relevant agency programs. Among the reports prepared to date:

- The Corps of Engineers and Shore Protection: History, Projects, Costs. IWR Report 03-NSMS-1, May 2002.
- Addressing Economic Considerations in Shoreline Protection: Proceedings of a Workshop for the National Shoreline Management Study. IWR Report 04-NSMS-2, January 2004.
- An Assessment of the Nation's Shoreline Change: A Review of the 1971 National Shoreline Study. IWR Report 04-NSMS-3, January 2004.
- Historical Origins and Demographic and Geological Influences on Corps of Engineers Coastal Missions. IWR Report 04-NSMS-4, January 2004.
- Regional Sediment Management Primer. May 2004, prepared in coordination with the ERDC.

A limited number of reports are available and may be ordered by writing Arlene Nurthen, IWR Publications, at the above Institute for Water Resources address, by e-mail at: Arlene.nurthen@usace.army.mil, or by fax 703-428-8171

ECONOMICS OF THE SHORELINE

An Annotated Bibliography for the National Shoreline Management Study

Prepared by:

Linda K. Lent

Chrysalis Consulting, LLC
P.O. Box 41015
Bethesda, Maryland 20824-1015

For the:

Institute for Water Resources
U.S. Army Corps of Engineers
Alexandria, Virginia

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Preface

This report is a product of the National Shoreline Management Study (NSMS). The NSMS was authorized by Section 215(c) of the Water Resources Development Act of 1999.

Acknowledgements

This document was prepared for the NSMS and the Institute for Water Resources (IWR), U.S. Army Corps of Engineers (USACE) by Linda Lent of Chrysalis Consulting, LLC. The Director of IWR is Robert Pietrowsky.

Direct supervision and support for this report was provided by Robert Brumbaugh (IWR), the Manager of the NSMS and Laura Zepp, Visiting Scholar at IWR. Laura Zepp and Jeffery Adkins (National Oceanic and Atmospheric Administration Coastal Services Center, Charleston, South Carolina) are co-chairs of the Economics Implications Work Group for the NSMS. USACE Headquarters (HQ) comments were provided by Harry Shoudy (Planning and Policy Division, now retired), Lillian Almodovar, and Janice Rasgus. Ms. Janice Rasgus provides HQ oversight and direction for the NSMS.

Executive Summary

This document reviews 100 existing studies and reports pertaining to the economic consequences of shoreline change and related issues. It is intended to serve as a resource for the National Shoreline Management Study (NSMS). The National Shoreline Management Study is an interagency effort to determine the extent and causes of shoreline change along the nation's coasts and to assess the resulting economic and environmental impacts. The U.S. Army Corps of Engineers (Corps) Institute for Water Resources (IWR) is managing the study, which was authorized by the Water Resources Development Act of 1999.

One objective of the NSMS is to assess the economic impacts of shoreline change (erosion and accretion) along the nation's coasts. Additionally, the NSMS is charged with recommending appropriate levels of Federal and non-Federal participation in shoreline protection at the study completion. This bibliography is intended to provide an initial inventory of existing literature and research findings that may be useful in fulfilling these two study charges. It is a first step in the process of developing a comprehensive annotated bibliography of relevant literature.

This bibliography is one of a set of early NSMS documents. Also included in the set is, "Addressing Economic Considerations in Shoreline Protection", the proceedings to a July 2002 workshop convened to identify and discuss economic considerations associated with shoreline protection.[1] Both the annotated bibliography and the proceedings were prepared as support materials for members of the NSMS economics workgroup as they develop an approach to fulfilling the study charges. Neither document should be viewed as establishing the NSMS economics workgroup's research priorities or methods.

The literature search conducted for this bibliography favored articles or reports published since 1990 and relating to three topics areas delineated by the NSMS study team:

(1) Understanding what market and policy incentives underlie public and private shoreline use and management decisions,

(2) Identifying the benefits and costs of shoreline protection, and

(3) Considering the fiscal impacts and financing of shoreline protection activities.

A total of 260 articles relating to these topic areas were found. One hundred were summarized in the annotated bibliography. The availability of current research pertaining to each topic area was assessed based on the sample of 100 articles reviewed. Based on this assessment, there appear to be no comprehensive studies that could be used directly to guide national policy. There are no studies that comprehensively evaluate what the overall effects of the Corps shoreline policy, past and present, have or will be on the Federal, state and local economies. The same appears to be true of the impacts of the coastal and shoreline policies and programs associated with other Federal agencies. Indeed, where there is more than one focused study of a subject, the findings may disagree.

Additionally, of the economic analyses reviewed, those conducted at the regional level tend to address a range of different questions about shoreline use and management using different techniques. Furthermore, even when two studies address the same questions, the analytic techniques employed still often differ. As a consequence, although there are many regional studies evaluating the benefits of beaches, the extent to which study results can be compared is limited.

[1]Available online at http://www.iwr.usace.army.mil/NSMS/nsmshomeframeset.html

The results of the literature review conducted for this bibliography suggest that:

(1) The existing literature provides a diversity of regional studies examining the benefits of beaches and shore protection. The results of such studies should not be aggregated to extrapolate findings for beaches nationwide without first accounting for the differences in analytical techniques and any potential policy issues guiding the application of those techniques.

(2) There are gaps in the information available on certain factors that could be significant determinants of the economic effects of shoreline change.

(3) There are several limitations in the empirical data and analytic tools available for measuring the benefits and costs of shore protection that have not yet been addressed in the literature.

To continue the process of constructing a comprehensive, updated bibliography that is readily available to all researchers, a web-based interactive bibliography will be developed. Such a tool should allow researchers to sort the articles, provide hot links to articles that are available on the Web and submit new research results for addition to the bibliography.

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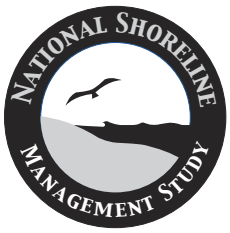


INTRODUCTION

This literature review surveys existing studies pertaining to the economic consequences of shoreline change. It is intended to serve as a resource for the National Shoreline Management Study (NSMS). The National Shoreline Management Study is an interagency effort to determine the extent and causes of shoreline change along the nation's coasts and to assess the resulting economic and environmental impacts. The Corps' Institute for Water Resources (IWR) is managing the study, which was authorized by the Water Resources Development Act of 1999.

One objective of the NSMS is to assess the economic impacts of shoreline change (erosion and accretion) along the nation's coasts. Additionally, the NSMS is charged with recommending appropriate levels of Federal agency participation in shoreline protection. This literature review provides an annotated bibliography containing studies and research pertaining to the economic impacts of shoreline change, including shoreline protection. Also included in the bibliography are studies providing information supportive of making recommendations on the appropriate levels of Federal and non-Federal participation in shoreline protection.

This bibliography is one of a set of early NSMS documents. Also included in the set is, "Addressing Economic Considerations in Shoreline Protection", the proceedings to a July 2002 workshop convened to identify and discuss economic considerations associated with shoreline protection.[2] Both the annotated bibliography and the proceedings were prepared as support materials for members of the NSMS economics workgroup as they develop an approach to fulfilling the study charges. Neither document should be viewed as establishing the NSMS economics workgroup's research priorities or methods.

This document is not intended to provide a critical review of the literature. Inclusion of an article should not be interpreted as an endorsement of its findings. The purpose of this bibliography is to provide an initial inventory of existing work relating to the economics of shoreline change. This inventory is a first step in the process of developing a comprehensive annotated bibliography of relevant literature.

The methods and criteria used to select articles for inclusion in the bibliography are described in the following section. The next section provides a summary of the contents and identifies areas of additional research needed. A third section discusses the availability of current research and contains conclusions. The final section contains the annotated bibliography.

[2]Available online at http://www.iwr.usace.army.mil/NSMS/nsmshomeframeset.html

METHODS AND SELECTION CRITERIA

Preparation of this report involved tracking down relevant articles and reports by economists active in the current economic evaluations of shoreline projects and annotating those articles as well as others that were available and pertinent. The methods used to identify potential articles included compiling dozens of bibliographies from reports and papers, sending out a general request to the coastal research community via the Delaware Coastal List Serve, contacting specific researchers and searching the World Wide Web.

General criteria for inclusion favored articles or reports written from 1990 forward that related to the three topics: Topic 1) Understanding what market and policy incentives underlie public and private shoreline use and management decisions, Topic 2) Identifying the benefits and costs of shoreline protection and Topic 3) Considering the fiscal impacts and financing of shoreline protection activities.

A total of 260 articles relating to these topic areas were found. In order to remain within the study budget and time frame, only a subset of 100 articles could be summarized in the annotated bibliography. Citations for all 260 articles will be listed on the NSMS website at http://www.iwr.usace.army.mil/NSMS.

Professional judgment was used in deciding which 100 articles to include in the bibliography. The selection decision was based primarily on whether an article was deemed to be current and whether or not another article describing similar research had already been included. Every effort was made to select as broad of a cross-section as possible of research topics and techniques.

Additionally, some types of articles and reports were excluded from the bibliography by design. For example, this bibliography does not include articles relating to environmental impacts. This decision was made to avoid duplicating the efforts of a separate NSMS "environment" workgroup that is already collecting and reviewing literature relating to the environmental consequences of shoreline protection and change. Data series were specifically excluded as well. Project-specific benefit cost analyses by the U.S. Army Corps of Engineers were also excluded as well as guidance related to the Corps or other entities for estimating shoreline protection values.

The 100 articles included in the bibliography were selected because they were judged to be current and representative of the existing body of literature. However, the reader should be aware that the articles not included may be equally as relevant and valuable as those that were annotated. The current bibliography should be considered a first step in the process of developing a more comprehensive annotated bibliography of literature relevant to the economics of shoreline erosion.

SUMMARY

The literature search conducted to prepare this bibliography was organized around three topic areas that are pertinent to the NSMS objective of assessing the economic impacts of shoreline erosion. A description of each topic area is provided below along with a brief summary of the relevant literature identified. Each summary identifies those issues for which little or no information was found in the reviewed literature.

Topic 1) Understanding what market and policy incentives underlie public and private shoreline use and management decisions

This topic area includes any literature addressing the question of how government policies and programs affect private and public shoreline use decisions. Some of the policies and programs searched for in the literature were: the National Flood Insurance Program (NFIP); Coastal Barriers Resource Act (CBRA); Federal shoreline protection projects; Stafford Act disaster assistance payments; Federal and/or state tax policies; and Small Business Administration loans. This topic area also includes any literature examining how changes in markets for beach services may affect shoreline uses.

About one third of the entries related to this topic area. Topics included examination of the effects of the National Flood Insurance Program (NFIP), the CBRA and Corps protection projects. No articles were identified relating to the Stafford Act or any other Federal Emergency Management Agency programs or policies. Nor were any articles identified that examine the potential effects of Presidential Disaster Declarations or Small Business Administration loans on shoreline management and use. No articles considered changes in user markets and their relationship to shoreline use. There were also no entries on the economic impacts of engineered interferences along the shoreline (e.g., dredging, hardening, pollution) on shoreline management and use. Finally, no articles were annotated that examined the impact of the Environmental Protection Agency (EPA) water quality testing procedures and other EPA programs or restrictions on shoreline use and management.

The results of this literature review suggest that there are some shortages in the available research identifying the effects of government policies and market conditions on shoreline use and management decisions.

Topic 2) Identifying the benefits and costs of shoreline protection

This topic area includes any literature evaluating the benefits and costs of shoreline protection. Such articles might include an examination of the economic criteria and analytic approaches that are being used to evaluate the benefits and costs of shoreline protection (e.g. regional economic impact analyses, benefit cost analyses etc.), as well as the findings of these analyses.

About two thirds of the articles reviewed related to the benefits and costs of shore protection,

notably the most comprehensively covered topic area. Many regional benefit studies were included. However, it should be noted that the regional benefit studies varied according to the region for which the study was undertaken and by the specific researcher(s). Papers and applications relating to specific techniques, e.g., random utility models, benefit transfers, travel cost methods, were found primarily in academic research.

No literature was found to relate the impacts of the benefit cost methodology on project design or funding. A variety of articles examined the measurement of recreation benefits and the component of property values associated with the shoreline, though again, the techniques for measurement and reporting results varied by region and researcher(s). A few articles considered the impacts of international tourism on the national economy and the potential loss of tourism dollars if U.S. tourists chose locations outside of the U.S. in lieu of visiting U.S. beaches. No articles were identified that examined the overall impact of existing Corps procedures limiting the Federal interest in shore protection to property protection. Several articles, however, examined other types of benefits that could be included as National Economic Development (NED) benefits.

Additionally, the literature reviewed did not address several limitations in the empirical data and analytic tools available for measuring the benefits and costs of shore protection, including

1. understanding the physical processes that result in storm damages to coastal structures and identifying methods for evaluating these damages,
2. obtaining sufficient empirical evidence to develop accurate estimates of the relationship between storm damages and the physical processes that produce those damages (e.g. stage damage curves),
3. evaluating the adequacy of near shore land values as measures of the value of land losses from coastal erosion, and
4. evaluating the effectiveness of new, more stringent coastal construction standards in reducing damages to coastal structures.

Topic 3) Considering the fiscal impacts and financing of shoreline protection activities

Literature considered for this topic area included any studies examining the fiscal impacts of shoreline change and protection and assessing the ability-to-pay for shoreline protection measures at the federal, state and local levels of government. Also sought out were studies examining financing mechanisms used by localities to pay for shoreline protection projects. Finally, any literature considering appropriate criteria for making equitable cost-sharing arrangements is also relevant to this topic area.

About one fifth of the articles included in the bibliography related to this category. Many articles touched on the growing body of literature examining benefits from shore protection that are not included in Federal NED calculations. For example, several articles described work done to measure the regional economic impacts of beaches or beach nourishment. Such studies are similar to the regional economic development (RED) analysis described in the Corps' planning guidelines. Another type of benefit considered was expenditures by international visitors to U.S. beaches, which represent exports to the U.S. economy. Also considered was the loss of benefits resulting from U.S. visitors who choose to vacation outside of the U.S. due to a lack of or deterioration of U.S. beaches (considered imports to the U.S. economy). A third issue dealt with was the question of how to handle the out-of-area or out-of-state visitors in the financing framework.

No articles were included that analyzed the current or future competitive position of the U.S. in the beach tourism industry with respect to what some believe is the relatively small investment for beaches compared to the investments of other countries. No articles were identified that analyzed the long-run implications of current or proposed federal cost shares on local shoreline management decisions. Research was included that examined the willingness-to-pay of users and the expected increases or avoided decreases in property values and how these measures can be incorporated in shoreline protection financing. Also included were academic studies of the fiscal impacts of strategic retreat and a few studies detailing the local area costs to manage the shoreline and the local revenues generated from shoreline use.

Another void is a realistic evaluation of the ability to pay for shoreline management. No research was found that fully considered the economic implications of the often espoused 'let the users pay' concept of funding shoreline management. Specifically, the literature reviewed failed to fully consider the consequences of financing mechanisms used by localities to capture the economic benefits enjoyed by beach users, such as user fees and property tax increases.

For example, none of the articles reviewed examined the consequences of charging users fees equal to the average willingness-to-pay for beach recreation. If the average willingness-to-pay is charged users, all those whose willingness-to-pay is less than the average value will no longer recreate on the beach. It is not clear, however, whether they will no longer use the beach because the new price just is not worth it to them or because they cannot afford the new price.

Some of the possible economic and equity implications of raising property taxes were also not considered in the literature reviewed. For example, if property-owners are assessed for identified increases in property values over and above the in-place property taxes, the tax may shift the ownership to higher income individuals, households or businesses.

CONCLUSIONS

This bibliography annotates a sample set of 100 articles drawn from the existing body of literature relating to the economics of shoreline change. It provides a first step in the process of developing a comprehensive bibliography. From the 100 articles annotated, the following conclusions can be drawn:

Conclusion 1: Many of the topics that are well documented in the literature are addressed from a variety of different analytical perspectives using different techniques. For example, the existing literature provides a diversity of regional studies examining the benefits of beaches and shore protection. Studies with a regional focus are often funded by state or local governments or private groups for different purposes. As a result, the researchers conducting such studies employ differing methods and assumptions.

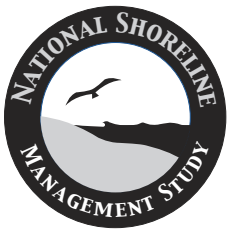
For example, in California, the State is attempting to demonstrate that there is a Federal interest in funding shoreline protection in spite of the fact that the projects do not have sufficient storm damage reduction benefits traditionally used to justify Federal participation. In Delaware, the economic benefits of beaches are studied to justify an ongoing State nourishment program that, in the absence of Federal protection projects, puts sand on the beaches to support Delaware's healthy tourism industry. By comparison, the State of Hawaii funded a regional benefit study to accompany an existing NED study to determine the national and regional economic benefits lost when international and U.S. tourists choose international destinations in place of a vacation in Waikiki. In Florida, regional studies are conducted to identify ways for private property owners to share the cost of local nourishment projects.

This diversity of study purposes and approaches provides much useful information about the benefits of shore protection from differing perspectives. However, the results of such studies should not be aggregated to extrapolate findings for beaches nationwide without first accounting for the differences in analytical techniques and any potential policy issues guiding the application of those techniques.

Conclusion 2: There are gaps in the information available on certain factors that could be significant determinants of the economic effects of shoreline change. Such factors include policies and programs such as the Stafford Act and Presidential Disaster Declarations, engineered interferences along the shoreline, federal cost share requirements for beach projects, and the analytic criteria and assumptions employed to evaluate the economic effects of shoreline change. There are no studies that comprehensively evaluate what the overall effects of the Federal government's shoreline policy, past and present, have been or will be on the Federal, state and local economies. The same is true of the impacts of the CBRA, FEMA programs of the Department

of Homeland Security (DHS), EPA programs and most especially, Federal Disaster Declarations. Indeed where there is more than one study of a subject, the findings may disagree.

Conclusion 3: There are several limitations in the empirical data and analytic tools available for measuring the benefits and costs of shore protection that have not yet been addressed in the literature.



NEXT STEPS

An ongoing effort is needed to build upon the preliminary work in this document to construct a comprehensive annotated bibliography of literature pertaining to the economic impacts of shoreline change, including shoreline protection. As indicated earlier, more than 260 citations were collected in the process of selecting and annotating the 100 entries in the bibliography. The remaining 160 citations that are not already included in the bibliography should be evaluated for relevance and, where warranted, added to the annotated bibliography. Moreover, the body of literature on the economics of shoreline management increases each year with new research. To maintain an updated bibliography that is readily available to all researchers, a web-based interactive bibliography will be developed. Such a tool should allow researchers to sort the articles, provide hot links to articles that are available on the Web and submit new research results for addition to the bibliography.

ANNOTATED BIBLIOGRAPHY

- Black, David E.; Donnelley, Lawrence P. and Settle, Russell F. (1990). "Equitable Arrangements for Financing Beach Nourishment Projects." *Ocean & Shoreline Management* 14, 191-214.

Summary: This paper presents a procedure for allocating economic benefits as estimated in U.S. Army Corps of Engineers benefit-cost analyses for selected Delaware beaches. The benefit categories analyzed are those of recreation value and property protection values. The findings indicate that 62% of the benefits result from (Corp's estimated) recreation benefits and 32% to property owners with remaining property protection benefits transferred to the Federal government (4.9%) and State and local government (0.8%) The authors then review taxing options and find that beach access fees are the preferred method for allocating nourishment costs to users and a special tax assessment for properties at or near the beach should be levied to allocate property protection benefits. Based on their analysis they conclude it is inappropriate to fund nourishment from general State revenues.

- Boyle, Kevin and Bergstrom (1992). "Benefit Transfer Studies: Myths, Pragmatism, and Idealism." *Water Resources Research* 28(3), 657-662.

Summary: The stated objective of this study is to facilitate the development of a systematic procedure for conducting benefit transfer studies. The authors propose idealistic criteria that include: the commodity being valued must be identical; the populations must have identical characteristics; and the assignment of property rights must lead to the same theoretically appropriate welfare measure. The authors apply their criteria to five studies along a river system to identify a study that will support a benefit transfer and finish the example rejecting all candidates. Moreover, the bias within the original study may prove disastrous to the transfer method. The authors conclude that benefit transfer should not be thought of as pulling existing valuation off the shelf and using the estimates directly but rather "existing data sets should be viewed as secondary data sets that may require supplementation with some primary data collection at the policy site and possibly some re-estimation."

➢ Brookshire, David S. and Neill, Helen R. (1992). "Benefit Transfer: Conceptual and Empirical Issues." *Water Resources Research* 28(3), 651-655.

Summary: The authors provide a conceptual perspective of benefit transfer but do not offer any testable hypothesis. Instead, a benefit transfer case study is presented to examine the problems and procedures of benefit transfer to estimate the benefits of pollutant loadings on 12 rivers. Eight studies were evaluated for transfer potential for five criteria and three studies were selected for benefit transfer. The authors cite four drawbacks to benefit transfers: a lack of clear guidelines for judging the adequacy or scientific soundness of existing studies; finding study sites that correspond to policy sites is difficult; market size is hard to determine; and extrapolation of study results using linear interpolation may not be plausible. The authors conclude that the benefit estimation process cannot be separated from the benefit transfer process and that benefit transfers should be subject to the same rigorous research as benefit estimation. They note that this could make the development of benefit transfer protocol very costly, which is ironic as the method is used as an attempt to save research dollars.

➢ Burlas, M., Ray, G.L. and Clarke, D. (2001). "The New York District's Biological Monitoring Program for the Atlantic Coast of New Jersey, Asbury Park to Manasquan Section Beach Erosion Control Project, Final Report". U.S. Army Engineer District, New York and U.S. Army Engineer Research and Development Center, Waterways Experiment Station.

Summary: Concern about the long term environmental impacts from beach nourishment projects prompted this $8.5 million study, conducted over a seven year period. The study area included approximately 21 miles of exposed, high-energy beaches that received more than 19 million cubic yards of sand since 1994. Conclusions indicate that there were no significant long-term adverse impacts from the project. All measurable impacts of beach nourishment to the surrounding environment were minor and short term. Moreover, beach nourishment provided nesting and rearing habitat for threatened and endangered species. There was no apparent difference in recreation fishing except for limited access to notched groins due to the specific characteristics of this project.

- Chao, Philip; Floyd, James L. and Holliday, William (1998). "Empirical Studies of the Effect of Flood Risk on Housing Prices." Institute for Water Resources, U.S. Army Corps of Engineers, Alexandria, VA.

Summary: The principle question addressed in this study is: Can empirical evidence be found that flood damages borne by flood plain activities are or are not capitalized into the fair market value of floodplain properties? The author asserts that a discount for location in the floodplain is different from a discount for flood damages and in order to separate them, a hedonic price model should include all floodplain attributes. In this study, existing literature on hedonic price models of the floodplain real estate market are reviewed. In addition, two hedonic price model cases are studied. The authors find that literature review and the case studies are insufficient to conclude the principle question in this study.

- Chapman, David and Hanemann, Michael (2001). "Environmental Damages in Court: The American Trader Case" in *The Law and Economics of the Environment*, edited by Anthony Heyes.

Summary: This paper presents the economic issues that were related to the American Trader Case where the American Trader steam tanker spilled 416,598 gallons of crude oil on 1.5 miles of Huntington Beach, California, from the point of view of the plaintiffs. This Case is the first jury verdict for natural resource damages ever awarded in the U.S. The paper is written by the economists who argued the Case. The Case involved no dispute over the economic methodology, both sides accepted the concept of "the polluter pays." Rather, the Case centered on defining satisfactorily "how much." Much of the trial focused on debating the techniques (current and prior surveys, average recreation use values from other areas) to estimate tourism losses from the spill. The jury awarded the plaintiff (the State of California) $18 million for an estimated 618,000 lost beach trips. They based the award on the plaintiff's requested amount less 10% for keypunch errors made by the plaintiff in the presentation and discovered by the defense. The jury applied a value of $13.19/visit rather than the $15/visit requested by the State.

- Colgan, Charles S. (2003). "The Changing Ocean and Coastal Economy of the United States: A Briefing Paper for Conference Participants" At the NGA Center for Best Practices Conference, Waves of Change: Examining the Role of States in Emerging Ocean Policy, Prepared for National Governors Association Center for Best Practices.

Summary: The United States Commission on Ocean Policy asked the National Ocean Economics Project to prepare an analysis of socio-economic factors affecting the coastal and ocean economy based on its project's data. This paper summarizes the key findings of this study, which include that 1) coast consists of four tiers, i.e. coastal states, coastal watershed counties, coastal zone counties, and nearshore; 2) the population growth pressures in coastal regions arise from the increasing population density rather than a disproportionate growth; 3) changing the most in the coastal region is employment and economic growth; 4) the coastal economy and ocean economy are not identical; 5) the ocean economy has gone through dramatic changes in the past decade; 6) the ocean economy is overwhelmingly urban in location, but comprises a larger portion of employment in rural areas; 7) we know far less about the ocean than any other natural resource. Additionally, the report also explores the implications of these trends for state policies in numerous areas, including coastal resource management, transportation, land use planning, economic development and economic data information.

- Cordes, Joseph J. and Yezer, Anthony M. J. (1995, February). "Shore Protection and Beach Erosion Control Study: Economic Effects of Induced Development in Corps-Protected Beachfront Communities." prepared for the U.S. Army Corps of Engineers Institute for Water Resources

Summary: The report examines the relation between Corps shore protection projects and potential induced development in coastal areas. First, the research examines a theoretical model of economic development. Next, three empirical tests are implemented: a survey of residents and two different econometric studies of beachfront development. The study results indicate that: 1) Corps shore protection projects have little or no statistically significant effect on inducing development, 2) residents of beach areas where Federal projects exist, have limited awareness of the Federal shore protection program or that the Corps has been involved in reducing risks through project construction, 3) awareness of the Corps decreases with wealth and increases with length of residence, 4) there is no observable significant effect on the differential between price appreciation in inland and beachfront areas due to Corps activity, and 5) the increasing demand for beachfront development can be directly related to the economic growth occurring in inland areas.

- Cordes, Joseph J. and Yezer, Anthony M. J. (1998). "In Harm's Way: Does Federal Spending on Beach Enhancement and Protection Induce Excessive Development in Coastal Areas?" *Land Economics* 74(1), 128-45.

Summary: This paper examines the concern that shore protection may provide perverse incentives for development within the coastal zone, placing property and residents at risk. The authors describe a model of economic development that can be employed to assess induced economic development caused by government programs designed to attenuate economic losses from storm damage and beach erosion. The empirical results indicate that "growth in beachfront communities has been prompted mainly by rising income and employment in inland areas, rather than by public investments in shore protection." This result suggests that the concern that beach protection projects encourage more development in harm's way is unfounded.

- Cordes, Joseph J.; Gatzlaff, Dean H. and Yezer, Anthony M. J. (2001). "To the Waters's Edge, and Beyond: Effects of Shore Protection Projects on Beach Development." *Journal of Real Estate Finance and Economics* 22, 287-302.

Summary: The authors develop a model of the spatial pattern of economic effects to test the location effects of the U.S. Army Corps shore-protection program. A modified repeat-sale house price index is used to measure price appreciation rates to the water's edge. To their initial surprise, they find "no significant evidence that shore-protection efforts have produced additional beachfront development in the Florida counties studied". The authors indicate the potential reasons that might lead to this result include the relatively small annual budget for beach nourishment, the significant land-use restrictions that come with a shore protection project and/or the fact that no major storms causing significant erosion occurred during their period of study. The methodology used in this paper is applicable where an environmental effect impacts real estate differently over space.

➢ Davidson, Todd, et al. (1992). "Beach Nourishment as a Coastal Management Tool: An Annotated Bibliography on Developments Associated with the Artificial Nourishment of Beaches." *Journal of Coastal Research* 8(4), 984-1022.

Summary: The article lists research related to beach nourishment and provides a brief description of each.

➢ Davis, Gray; Nicholas, Mary D.; Tsuneyoshi, Raynor and Schuchat, Sam (2002, January). "California Beach Restoration Study." Department of Boating and Waterways, State Coastal Conservancy, California.

Summary: The California Public Beach Restoration Act (PBRP) authorized a $10 million grant for beach nourishment projects and research during the fiscal year 2000-2001. Additionally, the California Department of Boating and Waterways and the State Coastal Conservancy were mandated to conduct a California Beach Restoration Study. This document reports the results of that study. The objectives of the study include: 1) detail the projects funded by PBRP; 2) assess the need for continued beach nourishment projects; 3) evaluate the effectiveness of the PBRP in addressing the need; 4) discuss ways to increase natural sediment supply in order to decrease the need to nourish the state's beaches. This study is divided into four parts. Part I discusses the state's beach setting and the economic benefits of California' beaches. Part II focuses on beach nourishment, including an introduction of basic concepts of beach nourishment, overview of the projects approved by 2000-2001 PBRP funding and outlines of future needs of the program, and analyses of past projects that are similar to those approved by PBRP. Part III is the study on natural sediment supply along the coast. The final part is a summary of the major conclusions and recommendations.

Economics are addressed in Chapter 3. Study findings estimate that beach visitors generate $61 billion in spending and $15 billion in tax receipts. Of the taxes generated, $4.6 billion accrue to the State, $2.5 billion to local governments and $8.1 billion to the Federal government. Approximately 28% of the revenues and taxes are generated by visitors from outside of California and about one third of those visitors are from outside the U.S. The chapter also lists 29 'conceptual' nourishment and protections projects ranging in cost from $170,000 to $13.7 million. The estimated benefit cost ratios (BCR) for these projects range from 0.28 to 65.14 with only four projects with a BCR of less than one. The results of a case study of the economic impacts of beach erosion in North San Diego County are presented. Survey results in combination with estimated losses of expenditures associated with a loss of visitors indicate that more than 50% of beach visitors (and associated revenues) will be lost if beach width is not maintained. The chapter concludes with a discussion of the safety and environmental benefits of beaches.

➢ Dean, Cornelia (1999). Against the Tide: The Battle for America's Beaches. New York: New York: Columbia University Press

Summary: The author writes this book to urge Americans to reconsider our attitudes toward our beaches. In this book, the author asserts that extensive development cannot coexist with an eroding beach, and most American beaches are eroding. The book starts with the 1900 Galveston hurricane tragedy, where 20% of the City's people died, and notes that very few people lived near a beach because of danger prior to the 20th century. However, 80% of Americans now live within an hour's drive of a coast. The author describes numerous attempts to save beaches and presents the physics of beaches and coastal ecology, unwise construction practices, public policy and conservation issues. The author also advocates policies that remove and/or control development along the shoreline, including removal of development, protection of undeveloped areas through public-private trusts, returning sand to beaches removed in dredging projects and limiting cutting into beaches for inlets and harbors.

➢ Deyle, Robert F.; Smith, Richard A.; Boswell, Michael R.; Baker, E. Jay; Falconer, Mary May and MacDonald, Joseph A. "The Costs of Hurricane Emergency Management Services: A Risk-Based Method for Calculating Property Owners' Fair Share" Cooperative Extension Service Institute of Flood and Agricultural Sciences, University of Florida.

Summary: Property owners should pay for municipal services in proportion to the benefits they receive according to the tax-benefit-equity principle. Premised on this theory, the objective of this paper is to demonstrate a method of distributing local emergency management costs associated with hurricanes based on relative risk and to apply it to Lee County, Florida. The authors examine the revenue-generating options of local governments and assess the legal feasibility of employing such a risk-based assessment mechanism. They find that a risk-based assessment can achieve tax benefit equity and be the means of financing local government costs of hurricane emergency management, while the impact on property owners are possibly modest.

- Delaware Public Administration Institute, Univ. Of Delaware for the Delaware Tourism Office (1995, August). "Southern Delaware: Beach Region Visitor Profile Study."

Summary: This report documents Delaware visitors. The effort involved a survey of 502 randomly selected travelers to the region wherein the definition of a visitor was having traveled at least 50 miles to the site. The purposes of survey include: profiling Delaware visitors; monitoring trends in visitor behavior and characteristics; providing detailed information on the vacationing habits of different groups; identifying market segments and potential target markets; and estimating visitor satisfaction levels. The results indicate that 14 percent of visitors were from Delaware while 77 percent of visitors were from nearby states. The average visitor traveled 210 miles, was in a group of 3.8 people, and spent 5.4 nights. 61 percent indicated that the major purpose of the trip was to visit the beach. The average daily expenditure per travel party per day was $66.34 for day visitors and $138.98 for overnight visitors. The report compares the profile for Southern Delaware beaches to a separate study for Brandywine Valley, another tourist region within Delaware.

- U.S. Fish and Wildlife Service (August 2002). "The Coastal Barrier Resources Act: Harnessing the Power of Market Forces to Conserve America's Coasts and Save Taxpayers' Money Division of Federal Program Activities ".

Summary: The Coastal Barrier Reauthorization Act (CBRA) of 2000 tasked the U.S. Fish and Wildlife Service to study the results of the Act passed in 1982. The report calculated and multiplied Federal disaster relief dollars per developed acre times the number of developed acres within a CBRA unit. The report presumes similar development for both areas and does not discuss how the probability of a disaster was accounted for. Future savings are estimated by multiplying the average savings in past years times the number of acres assumed to be developed in the future. The savings from infrastructure were estimated by multiplying the costs per acre for each type infrastructure by the number of acres in the System and then estimating an expected Federal share of the costs of infrastructure. The study concluded savings from 1983 to 1996 of $686 million and from 1997 though 2010 of $592 million. The authors note that while they estimate the Act has saved considerable taxpayers' money, the Act may be less effective in preventing development in coastal barriers.

➢ Edge, Billy L. et al. (1995). "Recreation Value of Urban Beaches." *Coastal Zone* 95, 553-554.

Summary: The article summarizes some national statistics indicating the importance of tourism and the role of U.S. beaches in the national and local economies and proposes an Executive Order to provide national policy on beach nourishment.

➢ English, Donald B.; Kriesel, Warren; Leeworthy, Vernon and Wiley, Peter C. (1996, November). "Economic Contribution of Recreating Visitors to the Florida Keys/Key West."

Summary: This paper is part of a project entitled "Linking the Economy and Environment of the Florida Keys/Florida Bay". The paper measures the economic contribution of visitor recreational uses of the Florida Keys/Key West to the Monroe County economy and the South Florida Regional economy including Monroe, Dade and Broward counties. The authors use two different types of regional economic analysis. Input-Output (I-O) analysis is used for three-county model. The I-O component of this model is the IMPLAN model. For the Monroe county model, the authors apply Census of Business wages-to-sales ratios and wages-to-employment ratios specific to Monroe County to spending estimates and match spending categories to Standard Industrial Classifications. The estimated results indicate that for the Monroe county model, visitors spent $1.19 billion during the survey period (June 1995-May1996), which generated $1.33 billion in total output, $506.01 million of income and 21,848 jobs. In the case of the three-county model, visitors spent an estimated $1.67 billion during the survey period, which generated $2.94 billion in total output, $1.69 billion in income, $1.92 billion value added and 27,822 jobs.

➢ Falk, James; Graefe, Alan and Suddleson, Marc (1994). "Recreational Benefits of Delaware's Public Beaches: Attitudes and Perceptions of Beach Users and Residents of the Mid-Atlantic Region." Prepared for the Delaware Department of Natural Resources and Environmental Control, Division of Soil and Water Conservation and the U.S. Army Corps of Engineers, Philadelphia District by the University of Delaware, Sea Grant College Program, Newark, DE.

Summary: The research effort involved 562 on-site interviews at five Delaware beach communities and a 1,000 piece mail survey over the five state area yielding a response rate of 39%. The research focused on three issues: (1) Willingness to pay for Delaware beaches, (2) Attitudes toward beach replenishment efforts and (3) Willingness to contribute toward a voluntary beach protection fund. The authors recommended that the increased consumer surplus from a wider beach be included as a benefit in determining the benefit cost ratio for beach nourishment projects. The results indicated users were willing to pay an average $3.01 per beach visit and $63.69 per year toward an annual voluntary beach protection fund.

- Freeman III, A. Myrick (1993). The Measurement of Environmental and Resource Values: Theories and Methods. Resources for the Future, Washington, D.C.

Summary: The objectives of the book are to provide an introduction and overview of the principal methods and techniques of resource valuation and to give practitioners in the field an up-to-date reference on recent developments in the theory and methods underlying the practice of resource valuation. The text provides a rigorous examination of benefit measurement definitions and theory, including the concepts of nonuse values, direct and indirect valuation methods, the effects of time on benefits, and uncertainty issues. Models discussed include property value models, hedonic wage models, and travel cost models.

- Griggs, Gary B. (1999). "The Protection of California's Coast: Past, Present and Future." *Shore & Beach* 67 (1), 18-28.

Summary: This paper examines three approaches dealing with coastal hazards in California: armor, retreat and beach nourishment. The costs, benefits and limitations or concerns for each approach are discussed. The author notes that armoring the shoreline is the typical response to coastal hazards in California and analyzes the different potential impacts of armoring. The author proposes four principles for future approaches to coastal hazards in California: 1) Armoring the entire coast of California is unaffordable and undesirable; 2) Retreat should be considered as a serious option; 3) increasing the extent or width of beaches is desirable; 4) Over the long-run, recreating or sustaining natural systems will be far less expensive and more effective than solutions requiring high construction costs and maintenance costs in perpetuity over the long run.

- Haefen, Roger H.; Phaneuf, Daniel J. and Parsons, George R. (2003). "Estimation and Welfare Analysis with Large Demand Systems."

Summary: In this study, the authors develop a demand system approach to estimate preferences for a large set of differentiated goods at the individual or household level. They apply this framework to a data set of Delaware residents' recreational day trips to 62 Mid-Atlantic ocean beaches in 1997. They find statistically significant, plausibly signed, and robust coefficient estimates. The main empirical results obtained include: increased age negatively impacts trips to all destinations; ownership of vacation property is positively related to increased beach visitation; several site characteristics are significant determinants of choice and respondents prefer beaches of moderate width. They also analyze welfare effects of changes in beach characteristics and availability in three scenarios: closing of Rehoboth Beach; closing of northern Delaware beaches and lost beach width at all Delaware, Maryland, and Virginia developed beaches. Their estimates suggest an aggregate welfare loss of $33.1 million for Delaware residents for the closure of Rehoboth Beach for one season, and losses of $61.3 million for the closure of all northern beaches; $20.1 million per season for lost beach width.

- Hanemann, Michael (1994). "Valuing the Environment through Contingent Valuation." *Journal of Economic Perspective* 8(4), 19-43.

Summary: This paper focuses on the use of contingent valuation to measure people's values for environmental resources. The author first describes how researchers go about making surveys reliable, mentioning recent innovations in sampling, questionnaire design, and data analysis. Following this, the author addresses various objections to surveys and considers compatibility between contingent valuation and economic theory. The author concludes that even without a market, there still exists a latent demand curve for nonmarket goods and contingent valuation is one way to measure this value. However, he also emphasizes that contingent valuation is not appropriate in all circumstances.

- Hillyer, Theodore M. (2003). "The Corps of Engineers and Shore Protection: History, Projects and Costs." IWR Report 03-NSMS01. Prepared for the National Shoreline Management Study, Institute for Water Resources, U.S. Army Corps of Engineers, Alexandria, VA.

Summary: This report documents major coastal storms, coastal legislation, significant coastal milestones and data on the U.S. Army Corps of Engineers shore protection projects during the 20th century. The chronology demonstrates that projects follow legislation, which follows public demands after devastating coastal storms. The report also defines the scope of the Corps' shore protection program over the period in terms of the number and types of protective measures, lineal distances of protected shorelines, actual costs and costs updated to September 2002.

- Houston, James R. (1996). "The Economic Value of Beaches." The Future of Beach Nourishment, Proceedings of the 9th National Conference on Beach Preservation Technology, Florida Shore & Beach Preservation Association, 271-280.

Summary: The paper documents the importance of tourism, particularly visits from abroad to U.S. beaches, to the economies of coastal states and that of the nation as a whole. The author traces the linkages from beach preservation to beach quality and from the quality of beaches to their attractiveness as tourist destinations. Hence the author establishes the importance of shoreline preservation to the U.S economy.

- Houston, James R. (2002). "The Economic Value of Beaches: A 2002 Update." *Shore and Beach* 70(1), 9-12.

Summary: This paper updates and supports the conclusions of Houston (1996). The author emphasizes that travel and tourism is both the world's and America's largest industry. As the key element of U.S. travel and tourism, beaches make a large contribution to America's economy. The author documents the evidence of the huge economic return of beach nourishment at Miami Beach. Moreover, the author observes that the U.S. is losing tourism due to the dramatic increase of worldwide competition for international tourism and by failing to match the expenditures made by other countries to protect and promote tourism.

- Kaoru, Yoshiaki (1993). "Discrete-Choice Valuation of Beach Recreation Benefits for Tourists and Local Residents." Marine Policy Center, Woods Hole Oceanographic Institution, Woods Hole, Massachusetts.

Summary: This paper estimates the recreation benefits at a beach on Martha's Vineyard in Massachusetts by a discrete-choice contingent valuation method. Recreationists are separated into tourists and local residents. They are asked different questions regarding their recreation activities and willingness to pay for the access to beach. The author finds that the distinction between tourists and local residents influence their recreation benefits differently. The recreation benefits per trip for a tourist are significantly bigger than those for a local resident.

- King, Philip (2001). "Economic Analysis of Beach Spending and the Recreational Benefits of Beaches in the City of San Clemente." San Francisco State University.

Summary: This report provides policy-makers at the City, State and Federal level with the analyses of economic value and the fiscal impact of San Clemente's beaches to the City, State and national economies. This study is based on a survey conducted in the summer of 2001, which profiles visitors to San Clemente's beaches. The fiscal impact analysis indicates that the City itself generates $1.65 million in revenues from beach-related spending, whereas the total City costs for all kinds of services totals $1.55 million. The economic impact analysis suggests that the City's beaches generate $132 million per year for the State of California, $4.16 per beach visitor in direct state taxes and $10.32 in direct federal taxes. The author estimates the economic value of beaches to be over $37 million per year. The main conclusion the author draws from this report is that the City does not generate sufficient revenues and hence should not be expected to pay for nourishment projects when most of the benefits from theses projects go to the State and Federal government. The author asserts that the State and Federal governments should be more involved in nourishment projects.

- King, Philip and Symes, Douglas (2003). "The Potential Loss in Gross National Product and Gross State Produce from a Failure to Maintain California's Beaches." prepared for the California Department of Boating and Waterways.

Summary: This study examines how much the U.S. and the State of California would lose if California's beaches cease to exist. Based on survey results, in the absence of California beaches, the total annual economic loss including direct, indirect and induced effects would be $8.3 billion to the California economy while losses to the federal economy would equal $6 billion. An estimated 38,000 jobs are associated with this economic activity. The direct spending loss is estimated at $2.4 billion. The federal government would lose $299 in direct tax losses. The estimated annual federal cost of shore protection is $12-$18 million, or 4-6% of the direct Federal tax loss if California beaches are unavailable. The authors found that a significant number of visitors would travel outside of California and outside of the United States in the absence of California beaches.

- Klein, Yehuda; Osleeb, Jeffrey, and Viola, Mariano (2003). "Tourism-Generated Earnings in the Coastal Zone: A Regional Analysis." Journal of Coastal Research, 20(0), 000-000.

Summary: This paper traces the linkages between beaches and tourism. More specifically, the authors build up a regional model to quantify the relationship between tourism-generated earnings and proximity to the coast. A location quotient is created to indicate the importance of tourism to each county, which is a measure of the share of tourism-related employment in the local economy relative to its share in the nation as a whole. The proximity to the coast for each county is obtained through a Geographic Imaging System. Their findings suggest that tourism-generated earnings, as a percent of total earnings, are concentrated in counties that lie within 40 kilometers of the coast while they are not sensitive to distance from the coast for those counties that are beyond this distance. They also raise some issues for future research of the relationship between beaches and tourism: the importance of beach quality to the tourism industry; the importance of other amenities; and the extent to which a common set of causes explains tourism and economic phenomenon in the coastal zone.

➢ Kling, Catherine L. (1997). "The Gains from Combining Travel Cost and Contingent Valuation Data to Value Nonmarket Goods." *Land Economics* 73(3), 428-439.

Summary: This paper investigates the potential benefits of combining contingent valuation and travel cost data for estimating welfare. The author extends the single-bounded contingent valuation of the combined model to a double-bounded version of the contingent valuation component. The potential gains in reduced bias or increased precision is also measured via simulation experiment. The simulation results suggest the possible substantial gains in reducing bias and improving precision from combining two methods. It is also indicated that improved precision can be obtained by moving from single-bounded to double-bounded valuation in the combined model. The author suggests that further research on improving combined models is warranted.

➢ Kopp, Raymond J. and Smith, Kerry (1993). Valuing Natural Assets: The Economics of Natural Resource Damage Assessment. Resource for the Future, Washington, D.C.

Summary: The book presents a collection of papers pertaining to the economics of natural resource damage assessment. The book is divided into four parts: Part 1 examines the legal environment surrounding damage to natural resource; Part 2 examines strategies to measure natural resource damage; Part 3 discusses conceptual dimensions of damage assessment; and Part 4 suggests areas and strategies for additional research.

➢ Kriesel, Warren; Randall, Alan and Lichtkoppler, Frank (1993). "Estimating the Benefits of Shore Erosion Protection in Ohio's Lake Erie Housing Market." Water Resources Research 29 (4), 795-801.

Summary: The objective of this research is to estimate the benefits of erosion protection for private property owners along the Ohio shoreline of Lake Erie. A hedonic model is employed to estimate the benefits from erosion protection. An option price model suggests that the marginal implicit price of GEOTIME equals the consumer's marginal willingness to pay for erosion protection, wherein GEOTIME is defined as the expected number of years until the setback distance equals zero given the property's historical erosion rate. The authors argued that if the option price model is correct, then the demand for erosion protection will equal its marginal implicit price curve. The estimated results show that a protection device lasting 8 years would add nearly $5,500 to property value (from an initial GEOTIME of 20 years), while a device that is engineered to last 20 years would increase property value by $11,000.

- Kriesel, Warren; Landry, Craig and Keeler, Andy (2000) "Coastal Erosion Hazards: the University of Georgia's Result".

Summary: This research effort involves the economic effects of flood insurance pricing and availability within the National Flood Insurance Program (NFIP). The report includes five sections. The first section presents the results of their mail survey from property owners. Section 2 employs hedonic price analysis for four regions. The third section describes an empirical model of property owners' decisions to buy flood insurance. Section 4 uses logistic regression to analyze the possible response from property owners if additional erosion-damage coverage were offered under the NFIP. The final section reports the effect on property values if beach recreation is adversely affected by coastal armoring. The key findings in this study are: Flood insurance does not appear important in the real estate market; the demand for flood insurance is unresponsive to price changes; and coastal armoring increases the value of waterfront properties but reduces inland property values if the recreational beach is damaged.

- Kriesel, Warren and Friedman, Robert, (2002). "Coastal Hazards and Economic Externality: Implications for Beach Management Policies in the American Southeast." The John Heinz _ Center for Science, Economics, and the Environment.

Summary: The authors use data on about 1,200 properties in nine southeastern U.S. counties to analyze at the scale of a community the economic effect of both beach nourishment and shoreline stabilization. The results demonstrate that beach nourishment increases property values for both waterfront properties and for non-waterfront properties a few rows inland. However, shoreline stabilization lowers property values for non-waterfront properties. Furthermore, waterfront property values decline as a result of increasing shoreline stabilization programs for waterfront properties.

- Lansford, N.H. and Jones, L.L. (1995). "Recreational and Aesthetic Value of Water Using Hedonic Pricing Analysis." *Journal of Agricultural and Resource Economics* 20, 341-355.

Summary: In this paper, the hedonic price approach is used to determine the implicit price of recreational and aesthetic (RA) value for a central Texas lake. The estimated results suggest that statistically significant RA characteristics of housing are distance to the lake, scenic view, waterfront location, and water level. Marginal value analysis indicates that proximity to the lake is the most important component of RA value. Waterfront properties include a premium, but marginal RA price falls rapidly with increasing distance. The aggregated RA prices for all properties within 2,000 feet of the lake suggest that 75% of total RA price resides in lakefront property and composes 15% of the total market price of housing. The estimated marginal RA value of lake water ranged from $110 to $136 per acre-foot, depending on lake level.

➢ Leeworthy, Vernon R. and Wiley, Peter C. (1991), "Recreational Use Value for Island Beach State Park," Strategic Environmental Assessments Division, Office of Ocean Resource Conversation and Assessment, NOAA.

Summary: This paper utilizes a travel cost model to measure the values of consumer surplus per person per day for Island Beach State Park, using individual visitor data. The authors apply several model specifications using linear and semi-log functional forms. The authors also study impacts on estimated consumer surplus values of including the opportunity cost of travel time, eliminating model outliers and differing methods of calculating consumer surplus. They find that the best model is the one that uses the semi-log functional form, omits the opportunity cost of travel time and eliminates model outliers. By using this model and the errors of measurement in the dependent variable method of calculating consumer surplus, the authors obtain an estimate of consumer surplus per person per day of $15.44 in 1988 dollars, with a mean value of $ 18.25 and a median value of $23.37.

➢ Leeworthy, Vernon R. and Bowker, J.M. "Nonmarket Economic User Values of the Florida Keys/Key West," SEA Division, National Ocean Service, NOAA.

Summary: As part of a project entitled "Linking the Economy and Environment of Florida Keys/ Florida Bay, this report provides estimates of the nonmarket economic user values of recreating visitors to the Florida Keys/Key West that participated in natural resource-based activities. First, the authors demonstrate a conceptual model that links the environment and economy in the Florida Keys/Key West. Following up, travel cost demand models were used to estimate price elasticities and nonmarket economic user values per person-trip for both the summer and winter season. They identified significant differences in price elasticity between summer and winter season visitors, for Hispanic visitors during the summer season, and for day trip visitors during the winter season. The estimates indicate that the weighted average per person-trip user value was $740 and $561 for all summer season visitors and all winter season visitors, respectively. Then the annual user values were estimated by multiplying estimates of the total number of person-trips by the per person-trip of different groups. They yielded the result of a total annual user value of about $1.2 billion. The authors also obtained the total asset value of the resources as $24.1 billion at a 5 percent interest rate and $40.2 billion at a 3 percent interest rate. Finally, the authors lay out the possible uses of nonmarket economic values.

- Leeworthy, Vernon R. and Wiley, Peter C. (2003, April). "Profiles and Economic Contribution: General Visitors to Broward County, Florida 2000-2001." National Ocean Service, NOAA.

Summary: This report is part of paper called the "Socioeconomic Study of Reefs in Southeast Florida, 2000-2001." The authors provide a profile of the "General Visitor" population of Broward County for summer and winter visitors. Moreover, the authors measure the economic contribution that visitors make to the Broward County economy. Visitors are defined as those who are not permanent residents of Broward County. Using the input-output model "IMPLAN", the authors estimate the economic contribution by value added, output/sales, income and employment opportunities, and indirect business taxes in Broward County. The estimated results indicate that the total $3.54 billion of visitor spending generated $3.08 billion in output, $1.68 billion in value added, $1.09 billion in income, $200 million in indirect business taxes and 49,922 jobs. The same kind of studies has also been conducted for Palm Beach, Miami-Dade and Monroe counties.

- Lent, Linda; Jones, Christopher and Jack Faucett Associations (1998). "The Economic Effects of a Five Year Nourishment Program for the Ocean Beaches of Delaware."

Summary: This research effort investigates the economic benefits and activities, as well as the beneficiaries, associated with Delaware's ocean beaches. To identify the economic value of beach nourishment, economic benefits and economic activity are estimated for two scenarios: with and without beach nourishment. Economic benefits of beach nourishment are the reduced value to the economy in the absence of nourishment. Two major categories of economic benefits related with beach nourishment are measured: the consumers' surplus for recreation value of the beach measured by willingness-to-pay of visitors and the component of the housing prices that is influenced by the beach width estimated by a hedonic model. The results indicate that an annual estimated 5.1 million person trips yield a consumers surplus in excess of $380 million. Without the State's nourishment program, within five years an estimated 268,000 visitors will be lost with an associated reduction in consumers surplus of $20.1 million and $30.2 million in tourism revenues. Beach area property values would drop an estimated $43.3 million while the State would avoid $9 million in nourishment costs.

- Lent, Linda; Holleyman, Chris and Ajayi, Olu (2001). "The Economics of Urban Beaches." Proceedings of the NSBPA 4th Annual Conference, Hoboken, New Jersey.

Summary: This paper discusses the definition of urban beaches from an economic perspective and describes a methodology used to measure the component of property values attributable to an adjacent urban beach. The result of a hedonic model developed for the case of the City of Virginia Beach is presented. The results indicate that 19% of the market value of the properties around the urban beach in the study area appears to result from the proximity to the urban beach. Additional measures of the value of urban beaches are suggested for future research.

- Lent, Linda (2002). "A Preliminary Estimate of the Regional and Federal Economic Benefits of Nourishment at Waikiki Beach." Presented at California and the World Oceans.

Summary: In this study, the author investigates the economic impacts of failing to nourish depleted sections of Waikiki beach and associated losses in tourism. The paper traces tourism expenditures through the local, state and national economies and the incident of benefits at each level. The author estimates that the full economic value of tourism expenditures at Waikiki exceeds $5 billion and that $181 million in tourism industry purchases are lost each year due to erosion in Waikiki involving the loss of more than 5,000 jobs. The impacts on the national economy are significant. The annual loss of exports (from losses of international visitors) is an estimated $67 million while the loss in avoided imports resulting from U.S. visitors who choose an international destination in lieu of visiting Waikiki is an additional $41 million.

- Lent, Linda (2002). "What are the Maintenance, Management and Emergency Costs associated with Beach Nourishment Projects." PowerPoint presentation to the NSMS Task Force Workshop.

Summary: In this presentation, the author discusses the definitions of the terms beach maintenance, management and emergency costs associated with a beach nourishment project and the factors that determine them. The presenter also demonstrates several examples of beach-related costs collected during prior research and summarized as follows: 1) There are different shorelines and conditions in coastal areas; 2) There are different kinds of nourishment; 3) There is a lack of data caused by the nonstandard methods of conducting shoreline maintenance and management and related accounting; 4) There are problems with emergency data on federal expenditures and National Flood Insurance Program claims related to the highly fragmented management of those functions.

- Lindsay, Bruce E.; Halstead, John M.; Tupper; Helen C. and Vaske, Jerry J. (1992). "Factors Influencing the Willingness to Pay for Coastal Beach Protection." Coastal Management 20 (3): 291-302.

Summary: This paper examines factors that influence coastal beach visitors' willingness to pay for a beach erosion control program. The authors utilize a Tobit model to analyze survey data obtained from recreational beach users at Maine and New Hampshire beaches. Eight variables hypothesized to affect a beach visitor's willingness to pay to support a coastal beach protection program are investigated. The authors find that the number of years visiting a particular beach, income level, familiarity with beach protective laws, respondents' state of residence, and the presence of sand dunes are statistically significant. The results indicate that: 1) recreationists with a longer history of visiting a particular beach support the protection program more favorably; 2) sand dunes represent a physical beach attribute that beach users feel strongly enough about to pay for; 3) beach users' knowledge of the beach protective laws increases their willingness to pay; 4) beach protection program is more attractive to those with higher incomes and in-state residence. The authors also discuss the implications of their findings for a beach erosion control program.

- Livingston, Guy and Arthur, Kellie (2002). "The Economic Impact of Pensacola Beach." The Haas Center for Business Research and Economic Development at the University of West Florida, Pensacola, Florida.

Summary: This study estimates the economic impact arising from the Pensacola beach-related tourism industry. The estimates are based on two types of spending flows. Visitors' spending was obtained from 1,957 surveys between 2000 May and 2002 April. Spending on the construction of lodging to accommodate tourists and seasonal residents was added to tourist spending and a multiplier model was used to estimate the total economic impact. The key findings of this analysis indicate that Pensacola Beach tourism generates approximately $277 million in local sales and supports over 4,000 local jobs. Beach tourism is identified as the strong engine of growth in retail and service-based business in the region.

- Loomis, John (1992). "The Evolution of a More Rigorous Approach to Benefit Transfer: Benefit Function Transfer" *Water Resources Research* 28(3), 701-705.

Summary: The authors consider the feasibility of transferring results from Contingent Value Methods (CVM) and Travel Cost Methods (TCM). They find that transferring across state lines results in poor performance. Transferring a multi-site TCM demand equation within state does better than the frequently used method of transferring the average benefits per trip.

➢ Mahan, B.L.; Polasky, S. and Adams, R.M. (2000). "Valuing Urban Wetlands: A Property Price Approach." *Land Economics* 76, 100-113.

Summary: In this paper, the authors employ a hedonic price model to estimate the value of wetland amenities in Portland, Oregon. The sales price of a property is related to structural characteristics, neighborhood attributes, wetlands amenities and other environmental characteristics. In particular, the authors are interested in the influence of the distance to and size of wetlands on property values. Their results indicate that the resident's value increased by $24 due to one acre increase in the size of the nearest wetland. Similarly, reducing the distance to the nearest wetland by 1,000 feet increased the value by $436. Home values were not influenced by wetland type.

➢ Manly Hydraulics Laboratory (2002), "Gosford City Beach Nourishment Feasibility Study – Stage Two Detailed Assessment of Potential Sand Sources," Manly Hydraulics Laboratory Report No. 929

Summary: This report documents an investigation undertaken for the Gosford City Council (NSW, Australia) into the feasibility of beach nourishment for the Gosford City open coast beaches. Beach nourishment is urgently required in these areas to maintain the sandy beach amenity and to provide protection to property at significant risk. Appendix C of the report is a detailed economic assessment. The basis of the assessment stems from the 'without project' scenario or 'Do Nothing' option. The analysis then proceeds with evaluation of costs and benefits of all 'Do Something' options as being incremental to the 'Do Nothing' option. Due to differing sand sources and methods of transport, subsets of each option have been evaluated individually.

➢ Mauriello, Mark N. (1991, July). "Beach Nourishment and Dredging: New Jersey's Policies." New Jersey Department of Environmental Protection, *Shore and Beach*, 59(3), 25-28.

Summary: The author explains and demonstrates two examples of regional sediment management undertaken by the State of New Jersey in the 1988-1991 periods. Prior to this period, while the State had required consideration of upland disposal of dredged sand quality material on beaches wherein the quantity exceeded 200,000 cubic yards, dredging activities of lesser size were routinely undertaken by open water disposal (sandcasting). However, with increasingly scarce State funds available for nourishment, the resource value of the sand in smaller projects was realized and in keeping with ongoing review and update of the State's Coastal Management Program, the State revised the policy so that in most cases inlet dredging projects must be designed with an upland (beachfill) disposal option. The author describes two case studies wherein material from smaller projects was used as beachfill material to supplement ongoing nourishment projects and extend the useful life of the nourished beaches.

➢ McConnell, K.E. (1990). "Double Counting in Hedonic and Travel Cost Models" *Land Economics* 66(2), 121-127.

Summary: This paper examines the theory of measuring the value of housing with respect to nearby water recreation opportunities and notes that a measure of recreational benefits to those using the houses is double counted if measured by a travel cost method and by a hedonic model that is designed to estimate the value of distance to the water in the housing price.

- McConnell, K.E. (1992). "Model Building and Judgment: Implications for Benefit Transfers with Travel Cost Methods." *Water Resource Research* 28(3), 685-700.

Summary: This paper provides a discussion of methods and hazards of benefit transfer and concludes that while practicable, the possibility for the inter-regional disequilibrium and attendant large differences in surpluses from non-market resources should not be overlooked. The theme for the paper is that analytical judgment should be the most important factor in benefit transfer.

- Morgan, Robert (1999). "Preferences and Priorities of Recreational Beach Users in Wales, UK" *Journal of Coastal Research* 15(3), 653-667.

Summary: In this research study, a beach user survey was conducted to investigate beach user priorities and preferences for 50 beach aspects at 23 beaches in Wales, UK, including 859 questionnaires. The results show that landscape/scenery (11.3% of total) was the most important factor, followed by bathing safety (8.3%) and a variety of pollution related factors such as bathing water quality, absence of sewage debris, litter and unpleasant odors. Beach facilities were generally given a lower priority. Substantial differences in beach user preferences according to the type of beach in terms of commercialization were observed. For example, a contrast was indicated between those intending to enjoy the natural characteristics of a beach and others preferring traditional beach resort qualities. However, bathing water quality possessed a relatively high priority for beach users preferring all beach types.

- National Research Council, Committee on Beach Nourishment and Protection (1995). *Beach Nourishment and Protection*. National Academy Press.

Summary: This book provides technical descriptions and analyses of how beach nourishment works, how its effectiveness can be measured, economic justification of beach nourishment, improvement of beach nourishment practices, the role of fixed structures in beach nourishment and the role of beach nourishment in flood protection and disaster assistance.

- National Research Council, Water Science and Technology Board (1999). New Directions in Water Resources Planning for the U.S. Army Corps of Engineers. National Academy Press.

Summary: This study was undertaken in response to the Corp's request to identify ways to shorten the Corp's planning procedure. The study suggests that the Corp's planning procedures do not take a significantly longer time than the planning of similar private sector water projects and concludes that the duration and cost of the Corp's planning procedures are generally reasonable. The report suggests several ways in which the Corps might reduce the time required for water project planning. However, some of the report's recommendations would actually lengthen the Corps' planning process. The report asserts that to maintain the quality of study, the Corps must keep updating analytic techniques, even if these increase the time of the planning process. The report also recommends that the federal Principles and Guidelines for Water and Land Resources Implementation Studies be thoroughly reviewed and modernized.

- Oden, Michael; Butler, Kent; Paterson, Robert; Cahoon, Joseph and Butler, Thomas (2000). "Cost-Benefit Evaluation of Coastal Zone Erosion Control Projects: Data Requirements and Methodology." Prepared for Texas General Land Office-Resource Management Division.

Summary: The main objective of this report is to provide the Texas General Land Office with a framework to rank erosion control projects according to their likely net economic benefits to the State of Texas. Conceptual issues, data requirements and estimation procedures are outlined for analyzing the economic costs and benefits associated with coastal erosion control projects. The report also provides a basic framework for estimating the net economic benefits of approved projects.

- Parsons, George R. (1991). "The Effect of Coastal Land Use Restrictions on Housing Prices: A Repeat Sale Analysis." *Journal of Environmental Economics and Management* 22, 25-37.

Summary: In this paper, the author uses a repeat sale analysis to study the economic effect of land use restrictions that limit residential development on land abutting the Chesapeake Bay in Maryland. This analysis examines the price changes on houses that sold both before and after restrictions were implemented. The result indicates that housing prices in the study area with and without water frontage increased by 46-62% and 14-27%, respectively after the restrictions. Prices near but not in the studied area increased by 13-21%.

- Parsons, George R. and Massey, D. Matthew (2003). "A Random Utility Model of Beach Recreation." The New Economics of Outdoor Recreation.

Summary: In order to estimate the effect of beach closures and/or erosion in the Mid-Atlantic region, the authors use the results of a mail survey of Delaware (DE) beach goers in two versions (simple multinomial and mixed logit) random utility maximization (RUM) model. The results are offered to estimate impacts of closures from oil spills (or other problems) as well as losses in the face on ongoing erosion, if left unchecked. The results indicate that the per trip loss for closure of a single beach (assuming all others remain open) is low, most below $1 per trip with the most popular beaches ranging from $1-$5. Losses increased notably when groups of beaches were closed, e.g., closure of all DE beaches indicated a loss of $25 per trip while northern and southern DE beaches only $12 and $3, respectively. Per-trip losses if beaches were narrowed to 75 feet or less ranged from $0.75 to $3 for small groups of DE beaches, the same losses to all of the Delmarva beaches indicated per trip losses of $5.

- Parsons, George R.; Massey, George R. and Tomasi, Ted, (2000). "Familiar and Favorite Sites in a Random Utility Model of Beach Recreation." *Marine Resource Economics* 14, 299-315.

Summary: In this paper, the authors offer an alternative approach to estimate the random utility model of beach recreation taking account of choice set familiarity and favorite sites. They argued that simply including familiar sites and favorite sites in the model causes the loss of important preference information. Hence they estimate the model by retaining all sites in the choice set, wherein familiar and unfamiliar sites are specified with different utility functions and favored sites are assumed to have higher utility than nonfavored sites. The data used in this paper are from a mail survey of Delaware residents using 400 respondents in the model. The estimation results indicate that travel and time cost is less important in determining site choice after accounting for familiar and favorite sites, which implies the conventional RUMs are inclined to understate recreational values. Their findings also suggest that unfamiliar sites tend to have a lower site utility after being considered unfamiliar in the model.

- Parsons, George R. and Needelman, Michael (1992). "Site Aggregation in a Random Utility Model of Recreation." *Land Economics* 68(4), 418-433.

Summary: To empirically estimate the degree of bias in using site aggregation in a random utility model (RUM) of recreation, the authors compare models that employ site aggregation to a model that does not, using a data set on fishing trips to lakes in Wisconsin in 1978 by residents of the state. The authors treat each lake individually and aggregate 1,133 sites to 9 sites at the region level and to 61 sites at the county level. Their estimation results show caution against the aggregation of nine sites in terms of both portraying behavior and assessing benefits. The aggregation of 61 sites lead to plausible estimators but the benefits often diverge substantially from their counterparts in the disaggregated models. Based on empirical results, the authors provide some advice to employing site aggregation in RUM's of recreation.

➢ Parsons, George R. and Noailly, Joelle, (2001). "A Value Capture Property Tax for Financing Beach Nourishment Projects: An Application to Delaware's Ocean Beaches."

Summary: To allocate the costs of previous beach nourishment projects, the authors utilize a hedonic framework wherein properties are assigned to five distance zones based on the distance from the property to the beach, with a separate category for oceanfront properties. The application uses the coefficient of the zones (wherein the coefficient represents the impact on property value of being in the zone compared to being in zone five, which is for properties more than 3,500 feet from the beach) to allocate property taxes by zone. Thus is it assumed that the nourishment projects confer benefits in the same proportion as the capitalized proximity value (as measured by the zone coefficient). For the most recent nourishment project, conducted in 1998, the estimated tax for oceanfront property was about $2,300. For properties in zone one, within 500 feet of the shoreline but not oceanfront, the rate was about $900. Zones two - four, each 1,000 feet in width and numbered from the shoreline, were $540, $250, $230 and $120. No tax was assigned to properties in zone five, more than 3,500 feet from the shoreline.

➢ Parsons, George and Powell, Michael (2001). "Measuring the Cost of Beach Retreat" *Coastal Management* 29, 91-103.

Summary: This paper estimates the economic cost through the policy of retreat in Delaware's ocean beaches. The authors first apply a hedonic pricing model to measure the property value in the study area using a data set of recent housing sales. Then the authors predict the loss of property values assuming that beaches migrate inland at historic rates of erosion along the coast area. The estimated results suggest the cost of retreat over the next 50 years to be about $291 million at the present values.

➢ Parsons, George R. and Wu, Yangru (1991). "The Opportunity Cost of Coastal Land-Use Controls: An Empirical Analysis." *Land Economics* 67(3), 308-316.

Summary: In this paper, the hedonic model is utilized to estimate the opportunity cost of displaced residential development or lost access to coastal amenities within the 1,000 foot buffer established for the Chesapeake Bay in Anne Arundel County, MD. The authors consider three groups: (1) houses that would have had view and frontage, (2) houses that would have had view but no frontage, and (3) houses that would have been less than .2 miles from the coast but with no view or frontage. Three functional forms are estimated: linear, double-log and linear Box-Cox. The chosen explanatory variables explain a big portion of the variation in housing prices and the coefficients on frontage, view and distance have expected signs and are statistically significant. The estimated results indicate that the in the Box-Cox regression the average value of loss access amenities for group one houses is $96,672/house; for group two, the average loss is $6,553/house; and the average loss is $447/house for group three.

- Pendleton, Linwood (1999). "Reconsidering the Hedonic vs. RUM debate in the Valuation of Recreational Environmental Amenities" *Resource and Energy Economics* 21(2), 167-189.

Summary: This paper reviews two revealed preference methodologies used to value changes in the environmental amenities of recreational sites: the random utility model (RUM) and hedonic travel cost model (HTC). The author shows that both models possess strengths and weakness that are crucial in determining their effectiveness as valuation tools. The contention over the methods is the result of the improper application of the models or misinterpretations of the theory that underlies the models.

- Pew Oceans Commission (2003 June). America's Living Oceans: Charting a Course for Sea Change

Summary: Cited as a landmark report, the Commission provides the first comprehensive review of U.S. Ocean policy in more than 30 years and recommendations for national ocean policy. The findings of the Commission indicate the following priority concerns: Coastal development and associated sprawl, degradation of our coastal rivers and bays by nutrient runoff, overfishing along the Atlantic and Pacific Coasts, invasive species and climate change. The priority objectives recommended by the Commission include: 1) Declare a principled, unified national ocean policy based on protecting ecosystem health and requiring sustainable use of ocean resources, 2) Encourage comprehensive and coordinated governance of ocean resources and uses at scales appropriate to the problems to be solved, 3) Restructure fishery management institutions and reorient fisheries policy to protect and sustain the ecosystems on which our fisheries depend, 4) Protect important habitat and manage coastal development to minimize habitat damage and water quality impairment, and 5) Control sources of pollution, particularly nutrients, that are harming marine ecosystems. Detailed recommended actions are included for each crisis area.

➢ Pilkey, Orrin H. and Dixon, Katharine (1996). The Corps and Shore. Island Press.

Summary: This book offers general discussions of coastal processes; beach replenishment; and the politics, science, and engineering of coastal protection. It also provides a comprehensive examination of the impact of the Corps's activities on American beaches.

➢ Pompe, Jeffrey J. and Rinehart, James R. (1994). "Estimating the Effect of Wider Beaches on Coastal Housing Prices." *Ocean & Coastal Management* 22, 141-152.

Summary: The authors use a hedonic housing price model to measure the marginal implicit price of a wider beach for Surfside Beach and Garden City in South Carolina. A wider beach would offer a combination of storm protection and recreational benefits to the property owner, benefits that would be capitalized into the market price of the property. The analysis in this paper indicates that housing prices are directly related to wider beaches. The study found that an increase in width from 70-80 feet increased the property value of houses on the water, 0.5 miles from the water and 0.75 miles from the water on average $6,408, $2,196 and $2,154 respectively.

➢ Pompe, Jeffrey J. and Rinehart, James R. (1995). "Beach Quality and the Enhancement of Recreational Property Values" *Journal of Leisure Research* 27(2), 143-154.

Summary: This paper employs a hedonic pricing model to examine the increased property values due to the improvement of beach quality measured by beach width in two South Carolina coastal towns. Their results indicate that for oceanfront property, increasing beach width from 79 to 80 feet increases the value of developed and undeveloped lots by $558 and $754, respectively. The same change of beach width increases the value of developed and undeveloped lots located half of a mile from the beach by $254 and $165, respectively.

➢ Pompe, Jeffrey J. and Rinehart, James R. (1995). "The Value of Beach Nourishment to Property Owners: Storm Damage Reduction Benefits." *Review of Regional Studies (Winter)*, 271-285.

Summary: This paper investigates the storm damage reduction benefits accruing to property owners of single-family homes from beach nourishment. The authors utilize a hedonic pricing model to measure the increased protection provided by wider beaches in two South Carolina oceanfront communities. Their study shows that besides the benefits accruing to beachfront property owners, significant benefits are also added to property farther back. Their estimated results indicate that the beach nourishment project proposed by Army Corps of Engineers will create approximately $63.8 million benefits to owners of single-family homes and hence result a benefit/cost ratio of 1.96.

- Pompe, Jeffrey J. and Rinehart, James R. (2000). "Toward a More Equitable Distribution of Beach Nourishment Costs." *Shore & Beach* 68(2), 15-17.

Summary: This paper discusses methods of measuring beach nourishment benefits and costs. The studies that estimate the value of wider beaches suggest that significant benefit accrues to properties closest to beach by beach nourishment projects. The authors assert that a formula with distance to the beach as the principal component would serve as a basis for a more equitable means of financing beach nourishment. The hedonic model can be employed to formulate such a financing plan.

- Powell, Michael (1995). "An Evaluation of the Costs Associated with Managing Delaware's Atlantic Ocean Coast through a Policy of Retreat" Master thesis submitted to the University of Delaware.

Summary: This paper estimates the economic cost of a shoreline management strategy of retreat in Delaware's oceanfront communities. A hedonic model is applied to estimate the market value of each structure within 600 feet of the ocean based on 14 attributes. The author develops a model that simulates shoreline migration, and computes the value of the loss of structures through a policy of retreat. The results indicate that during the first five decades of retreat, assuming a shoreline migration rate of three feet per year, a total of 447 residential structures and 85 commercial structures would have to be removed. The discounted present value of these structures is about $172 million. In addition to the empirical analysis, this paper also includes information on the historic management of the Delaware shoreline and criticisms related to the past management strategies.

- Salvesen, David A. (2002). "Land Use Change in the Coastal Barrier Resources System: The Effects of Conservation and Development Advocacy Coalitions." Dissertation submitted to the University of North Carolina at Chapel Hill.

Summary: Stated goals of The Coastal Barrier Resources Act (CBRA) are to 1) minimize the loss of human life, 2) reduce wasteful expenditures of federal resources and 3) protect the natural resources associated with the coasts. The Act was intended to discourage development in the coastal barriers by shifting the risks of development from the Federal government to the private landowner. The author provides results that indicate where state and/or local politics undermine CBRA and sufficient economic incentive is present, development occurs. The author cites examples of the undermining of CBRA goals including the payment of disaster assistance and recovery for development in North Topsail Beach and that the development in the Ft. Morgan peninsula is destroying scarce remaining habitat for the endangered Beach Mouse. The author finds that the added costs of developing within the System do not prevent development when economic pressures make the cost of private insurance and infrastructure affordable, though one of the unintended consequences of the Act may be to limit development within the system to the wealthy. In some areas, however, CBRA may have initiated the development of local regulations further protecting acreage within the system and encouraged local groups to promote protection of System areas as well.

➢ Santana, Gullherme (2003, Spring). "Tourism Development in Coastal Areas-Brazil: Economic, Demand and Environmental Issues" *Journal of Coastal Research, Special Issues* (35), 85-93.

Summary: This paper presents some critical issues related to marine tourism in Brazil. First, the authors analyze the factors that have influenced the tourism development in Brazil, including political stability and economic reform. Following this, the authors discuss the economic aspects of tourism. They estimate that over 90% of holiday travel within the country is to coastal areas, and that culture and technology are contributing to the increasing popularity of beaches. The potential negative impacts on the environment resulting from the beach-related activities are discussed. The authors also address the historical process of coastal occupation in Brazil and the implications of marine tourism in the country.

➢ Schmidt, David V. and Woodruff, Paden (1999), "Florida Beach Preservation - A Review" *Shore and Beach* 67 4), 7-13.

Summary: This paper documents the efforts in Florida to protect, preserve, and restore the State's shores. A brief history of the Federal and State shore protection programs is presented. Following up, Florida's efforts in beach and shore management are reviewed. Particularly, the state's 1998 legislation creating a dedicated funding source for beach restoration and nourishment is discussed. State guidelines, criteria, and procedures for participation in a comprehensive, long-term statewide beach management plan for erosion control are reviewed.

➢ Seymour, Richard J., et al. (1996) "Beach Nourishment and Protection: Executive Summary 5." Committee on Beach Nourishment and Protection: Richard Seymour (chairman) copyrighted by the National Academy of Sciences, reproduced verbatim in Shore and Beach, Volume 64.

Summary: The article presents a summary of the Committee's review of shoreline policy with a goal to answering the questions:

- Does beach nourishment work?
- How should success be measured?
- Is beach nourishment economically justified?
- How can beach nourishment applications be improved?
- What is the appropriate role of fixed structures with respect to beach nourishment?
- What is the role of beach nourishment in flood protection and disaster assistance?

Selected Committee findings indicate that beach nourishment is a viable engineering alternative, that success should be measured in the short term by dry beach width, volume of sand remaining after storms, damage avoidance assessments, and flood protection capability. Projected economic benefits and reduction in erosion will occur over a longer period and should be tracked and compared with the expectations of the local sponsors. Finally, they find that the definition of an 'engineered beach' used by FEMA does not sufficiently define the engineering adequacy of proposed beach restoration projects and that following a presidential declaration of a disaster, sediment losses from an engineered beach should be eligible for public assistance reimbursements.

- Silberman, Jonathan; Gerlowski, Daniel and William, Nancy (1992). "Estimating Existence Value for Users and Nonusers of New Jersey Beaches." *Land Economics* 68(2), 225-236.

Summary: This study provides empirical evidence on existence value for beach nourishment in New Jersey. Contingent valuation methods are employed. The authors focus on the analysis of users and nonusers of the beach to be nourished. Statistically significant differences are found between these two groups in terms of existence value bids. Among the significant variables are education, income, distance, and visiting substitute sites. A significant carryover bias is present in the existence value bids of respondents intending to use the beach. Hence the results support the hypothesis that existence value estimates for nonusers cannot be extrapolated from those of users. Their findings support the argument that the only valid measure of existence value is the willingness-to-pay amounts of non-users.

- Smith, V. Kerry; Zhang, Xiaolong and Palmquist, Raymond (1995). "Marine Debris, Beach Quality, and Non-Market Values." Discussion Paper 96-07, Resources for the Future.

Summary: This paper is a first attempt to evaluate the economic value of controlling marine debris on recreational beaches as an aesthetic characteristic of beaches and coastal areas. The estimation is based on a contingent valuation survey for recreational beaches in New Jersey and North Carolina. A Weibull survival model is estimated treating for and against votes as defining censoring points for the unknown willingness to pay distribution. Their results suggest that: 1) people distinguish situations with various amounts of debris when they are described using color photographs; 2) the pilot surveys imply that the measures of people's willingness to pay for debris control are consistent with the expectation that controlling debris improves the quality of coastal resources; 3) the local condition in New Jersey and Delaware seem to influence people's interpretation of the situations describing beach conditions in each area and the plans to control debris.

- Smith, Kerry and Palmquist, Raymond (1993). "Temporal Substitution and the Recreational Value of Coastal Amenities."

Summary: This paper presents a measure of the effect of the time of use on people's willingness to pay for beach amenities offered by a rental beach house. The findings indicate that distance from the house to the shoreline was found to be priced differently during different seasons of use, specifically, that oceanfront houses were discounted less in the pre and post season rental prices than other properties. The explanation offered is that the ocean view from a house along the shore is substituted in the off seasons for losing the quality of swimming or sunbathing during these times.

- Stronge, William B. (1994). "Beaches, Tourism and Economic Development." Shore and Beach 62 (2), 6-8.

Summary: The author asserts that Florida should devote resources to attracting high-spending tourists rather than manufacturing or high-technology industry in order to improve the State's economy. The author also asserts that maintenance of Florida beaches by beach nourishment is an important part of tourist development.

- Stronge, William B. (1991, February). "Recreational Benefits of Barrier Island Beaches: Anna Maria, Captiva and Marco, A Comparative Analysis." Proceedings of the Fourth Annual National Beach Preservation Technology Conference, Charleston, SC.

Summary: The author conducts a regression analysis on personal interviews of non-residents of these Florida Gulf beaches. The results indicate that willingness to pay for an hour of beach time diminished with length of stay on the beach, rose with income, and was highest for out-of-state users and highest on the beach that had been nourished recently. The study found that visitors within the state made 57.9 percent of the visits but the value of those visits was 44.4 percent of the total value of recreation visits. Visitors were categorized as out-of-state, island residents, local residents and state residents (which included island and local residents). The largest benefits flowed to out-of-state residents (55.6%), the second category are in-state visitors who do not live on or adjacent to the barrier islands and the smallest benefit category was to local residents.

- Stronge, William B. (1998). "The Economic Benefits of Florida's Beaches: Local, State, and National Impacts." Rethinking the Role of Structures in Shore Protection, Proceedings of the 11th Annual National Conference on Beach Preservation Technology. (pp. 321-330), Tallahassee, FL: Florida Shore & Beach Preservation Association.

Summary: This paper presents estimates of the statewide impact of Florida's beaches derived from the results of the microeconomic studies conducted by the author previously. Estimates include three of the benefits that accrue to the nation from Florida's beaches: namely the impact of the beaches on Federal income tax revenues, and the contribution of the beaches to the national balance of international payments through international tourism and international investment in beachfront property. The results indicate that Florida beaches contribute $428.6 million in personal and corporate Federal income tax revenue, attract two million international tourists who spend about $1.1 billion annually in Florida and that foreign residents own $3.5 billion of Florida coastal property. It is a first effort to assess the impact of the State's beach system on the economy.

- Stronge, William B. (1992). "The Economic Impact of the Macro Island Beach Nourishment: A Preliminary Analysis." Proceedings of the 5th Annual National Conference on Beach Preservation Technology.

Summary: The author analyzed pre and post nourishment real estate values on this island off the cost of Florida and determined that the nourishment project increased beach front property values by $9 million, at a cost of $4 million. The project was funded by a tax on beach front property owners. The increase in value for beach front properties was based on a comparison of beach front properties with no beach to non-beach front properties. When all beach front properties were compared to all other properties, no clear increase in appreciation of beach front over non-beach front could be identified.

➢ Stronge, William B. (1995). "The Economics of Government Funding for Beach Nourishment Projects: The Florida Case." *Shore & Beach* 63(3), 4-6.

Summary: The author asserts that 80 percent of the beach erosion in Florida is caused by inlets, many having been modified by man. The public interest in keeping these inlets open creates erosion problems for coastal property owners. Owners may respond by building seawalls or revetments which in turn may cause other erosion problems. Erosion also may be caused by protection structures built by the public for roads or other infrastructure. The author argues that the historic justification for federal involvement in beach nourishment which is limited to protecting public beaches and reducing storm damages is inappropriate. Instead he feels that beach nourishment projects should be justified by the national interest in keeping inlets open and protecting other public infrastructure which cause erosion. Additionally, he cites Federal interest in attracting foreign tourists to U.S. beaches. The same benefits for Federal interest are claimed for state interest. Local benefits are considered to be the highest, and include increased property values, local recreation, and local economic and fiscal impact.

➢ Stronge, William B. and Schultz Ronald, R. (1997). "The Beach Maintenance Program of Delray Beach: An Economic Study, 1995-1996." Prepared for the city of Delray Beach, Florida.

Summary: This report estimates the economic impacts of the beach maintenance program of Delray Beach on the economy of the City, Palm Beach County and the State of Florida during the studied period 1995-1996. The report is based on a personal interview survey of 1,093 beach users conducted between May 1995 and April 1996. The estimated results indicate that the beach restoration program added $125.1 million to local property values, contributed $46.4 million of economic production to the City, $96.6 million of economic production to Palm Beach County, and $56.2 million to the Southeast Florida. In addition, beach maintenance has created $4.4 million revenues for local governments annually.

- Sudar, R. Anne; Pope, Joan; Hillyer, Ted and Crumm, John. (1995). "Shore Protection Projects of the U.S. Army Corps of Engineers." *Shore and Beach* 63(2), 3-16.

Summary: The paper describes the first phase of an effort to inventory and document the costs and benefits of shore protection projects from 1950 to 1993. In the first phase, the authors identify the number, types of protective measures, lineal distance of protected shorelines, predicted and realized costs, predicted and actual sand quantities and projects future costs for authorized but unconstructed projects. The findings indicate that 56 of 82 projects were large enough for detailed assessment with 110.6 million cubic yards (cy's) of sand for initial beach restoration and 79.1 million cy's for renourishment at a total cost of $670.2 million with a federal share of $403.2 million. Cost estimates for projects under or awaiting construction are $2,055.3 million with an estimated Federal share of 65%. The authors found that total costs were four percent less than estimated while sand quantities were five percent more than estimated. There was more variation for individual projects but no revealed bias toward under or overestimation of costs or quantities. Project performance was better for larger projects (more than $50 million) and for more recent projects when compared with those undertaken more than 20 years ago.

- Terchunian, Aram, First Coastal Corporation and Smith, Jeannot (1998). "An Economic Snap Shot of Long Island's Barrier Island System." *Shore and Beach* 66(4), 9-11.

Summary: This paper profiles the beach-related economic value of Long Island's ocean shoreline from Jones Beach to Montauk, including information on property values, tourism and local taxes. The authors estimate that there is approximately $2.8 billion of private real estate in this area, 18 million visits to public parks, together creating a $1.5 billion annual tourist industry dependent on ocean beaches. Based on the substantial importance to local economy, the authors discuss the policy implication of shoreline management in this area. According to this paper, the area is substantially important to local economy.

- The John Heinz III Center for Science, Economics, and the Environment (2000). "The Hidden Costs of Coastal Hazards- Implications for Risk Assessment and Mitigation." Covelo, California: Island Press.

Summary: The objective of this study is to comprehensively document hidden costs of coastal disasters and to provide suggestions for developing mitigation strategies. The study asserts that the unreported costs are typically difficult to quantify, which is more due to inadequate reporting mechanisms than the difficulty in estimating dollar values. The study divides the impacts of hurricane Hugo into four categories: (1) the built environment; (2) the business environment; (3) the social environment, and (4) the natural environment and discusses each category in detail, including the potential costs, reported costs and hidden costs. In addition, the study provides new insight to risk assessment, mitigation strategies, and community planning.

➢ The John Heinz III Center for Science, Economics, and the Environment (2000). "Evaluation of Erosion Hazards." Final project report under Federal Emergency Management Agency contract EMW-97-C0-0375.

Summary: This report provides a comprehensive assessment of coastal erosion and its impact on people and property along our nation's ocean and Great Lakes shorelines. According to this report, approximately 25% of homes and other structures within 500 feet of the coast will fall victim to the effects of erosion within the next 60 years. Erosion-induced losses to property owners during this time are expected to be half a billion dollars annually. Claims due to these losses will have a significant effect on the National Flood Insurance Program (NFIP). This report provides recommendations for improved management of coastal erosion hazards and adjustments in the NFIP to reflect this risk.

➢ Trembanis, A.C., and Pilkey, O.H. (1999), "Comparison of Beach Nourishment along the U.S. Atlantic, Great Lakes, Gulf of Mexico, and New England Shorelines" Coastal Management 27: 329-340

Summary: This article summarizes several previous surveys that examine beach nourishment in four U.S. regions: New England, the East Coast barrier islands, the Gulf Coast, and the Great Lakes shorelines. It is suggested that a total of 1,305 nourishment episodes on 382 beaches are recorded at a total estimated cost of about $1.4 billion. In this study, the authors define a nourishment episode as an event in which new sand is artificially placed on a beach to increase its volume, while a beach nourishment project refers to a series of nourishment episodes in a location. The study indicates that the East Coast Barrier islands have the most extensive nourishment in terms of volume and costs. An estimated 65% to 85% of the beach nourishment projects have a federal funding component. Annual expenditures and sand volumes for beach nourishment are increasing, while the cost of per cubic yard of nourishment sand remains constant over the time. The volumes of sand needed for subsequent nourishment episodes on each individual beach do not decrease.

- U.S. Army Corps of Engineers (2000). "Hurricane Fran Effects on Communities with and without Shore Protection: A Case Study at Six North Carolina Beaches." IWR Report 00-R-6, Institute for Water Resources, Alexandria, VA.

Summary: The primary objective of this study is to determine if the presence of the Corps projects had a measurable impact on damages suffered during the storms in four areas along the North Carolina coast that experienced two hurricanes during the summer of 1996. The major findings are the areas protected by Corps projects received less damage in total property value than did the unprotected areas. Differences in physical storm parameters were not significant enough to explain the spread in damage. Offshore geology likely contributed to damages and lack of damages. The report draws the conclusion that beach nourishment projects do reduce hurricane storm damage and hence reduce Federal disaster recovery costs.

- U.S. Army Corps of Engineers (1994). "Shoreline Protection and Beach Erosion Control Study, Phase I Report: Cost Comparison of Shoreline Protection Projects of the U.S. Army Corps of Engineers." IWR Report 94-PS-1, Institute for Water Resources, Alexandria, VA.

Summary: This report represents the Phase I effort of a two-phase study to evaluate the effectiveness of the Federal shore protection program performed by the U.S. Army Corps of Engineers. This part of study defines the scope of the Federal shore protection program over the period 1950-1993, including a comparison of actual and estimated project costs, a comparison of actual to estimated sand volumes used in the restoration and subsequent nourishment of projects, and a projection of future costs.

- U.S. Army Corps of Engineers (1996). "Shoreline Protection and Beach Erosion Control Study, Final Report: An Analysis of the U.S. Army Corps of Engineers Shore Protection Program." IWR Report 96-PS-1, Institute for Water Resources, Alexandria, VA.

Summary: This report represents the integrated results of a two-phase study conducted by the U.S. Army Corps of Engineers. The Phase I effort was published the Institute of Water Resources report, "Shoreline Protection and Beach Erosion Control Study, Phase I: Cost Comparison of Shoreline Protection Projects of the U.S. Army Corps of Engineers." The second stage emphasizes benefits and the economic impact of shore protection projects as well as the associated environmental effects. It also refines the analysis on project costs and overviews Federal programs involved in risk management in the coastal zone.

- U.S Army Corps of Engineers (2001). "The Distribution of Shore Protection Benefits: A Preliminary Examination." Draft Report.

Summary: The purpose of this study is to evaluate the distribution of two types of economic effects of a shore protection projects between the local and national interests: national economic development (NED) benefits and regional economic development (RED) benefits. Three core questions are addressed in this study: 1)Who benefits from shore protection projects? 2)What is the distribution of project benefits? 3) Do increases in tax revenues that stem from Federal shore protection projects affect the capacity of non-Federal sponsors to pay for the projects? The report demonstrates a method of comprehensively evaluating the benefits of beach nourishment projects that can be consistently applied across all shore protection projects.

➢ Valverde, H. R.; Trembanis, C. and Pilkey, O.H. (1999). "Summary of Beach Nourishment Episodes on the U.S. East Coast Barrier Islands." *Journal of Coastal Research* 15(4), 1100-1118.

Summary: The paper estimates that since 1923 approximately 350 million cubic yards of sand have been placed from Long Island, NY to Fisher Island, FL in more than 573 nourishment projects at 154 locations. The authors indicate that the use of nourishment has increased since the 1960's and most of the volume (65%) has been placed under federally sponsored projects, but that projects sponsored by state and local efforts are increasing. The authors categorize funding sources from 1923 - 1996, as a percent of total sand volume (using the dominant type of project funding when multiple sources are used) into six funding types as follows: Federal Storm and Erosion - 43%, Federal Navigation – 14%, Federal Emergency – 6%, State/ Local – 18%. State – 2%, Local/Private – 9% and unknown – 8%.

➢ Van De Verg, Eric and Lent, Linda (1994, June). "Measuring the Price Effects of Shoreline Erosion in Chesapeake Bay Area Properties using the Hedonic Price Approach." Chesapeake Research Consortium Publication No. 149, 280-289.

Summary: In this report, an examination of transactions in shoreline areas along the Chesapeake Bay in Calvert County, Maryland is undertaken to determine market value losses due to erosion within the framework of a hedonic price index model. The authors contend that not only do shoreline property owners suffer market value losses attributable to erosion, but all property owners within the adjacent community suffer losses as well. Statistically the percent of loss for oceanfront and non-oceanfront houses (within the same community) is approximately equal. The results in this report indicate the average loss per property in Calvert County, Maryland, was $3,474 per foot of shoreline eroded.

➢ Wakefield, Jeffrey R. and Parson, George R. (2003). "A Comparison of Nourishment and Retreat Costs on Delaware's Ocean Beaches." *Shore and Beach* 71(3)

Summary: The authors compare the costs of two competing policy options for managing Delaware's eroding ocean beaches over the next 50 years: beach nourishment and retreat. They find that the cost of retreat is more than three times greater than the cost of nourishment. The authors estimate the 50 year cost of continuing to nourish is $48 - $60 million whereas the 50 year cost of retreat is between $156 and $319 million. Hence, their estimated results suggest that Delaware should continue its current policy of beach nourishment.

➢ Wiegel, Robert L. (1994). "Ocean Beach Nourishment on the USA Pacific Coast." *Shore and Beach* 60(4), 2-26.

Summary: The author presents an extensive compilation of papers and information relating details of the shoreline management on the Pacific coast, primarily in southern California. He notes that nearly every harbor in southern California is artificial, that requirements for maintenance dredging vary substantially by site and there are major differences among and within littoral cells. In terms of sediment management, he notes that rivers and creeks are the major natural source of sand and dams have had a serious and detrimental effect on beaches. Also described are several feet of subsidence at three beaches during only a few decades as a result of the withdrawal of oil and gas from underlying fields affecting Huntington Beach, Long Beach and Redondo Beach. He sites sources dating to the 1930's stating that "where there is alongshore transport of sand, harbor entrances and other structures built in the nearshore region such as breakwaters cause erosion downdrift, and that this should be remedied as a part of the cost of the harbor."

➢ Yochum, Gilbert R. and Agarwal, Vinod B. (1998). "Economic Impact of Virginia Beach." Prepared for the Committee on the Value of Public Beaches, Bureau of Research, College of Business and Public Administration, Old Dominion University, Norfolk, VA.

Summary: The purpose of this study is to provide an overview of the tourist industry in Virginia Beach and its effect on the region and the Commonwealth of Virginia. They estimate that at least 1.7 million tourists visited Virginia Beach during the summer of 1998, spending about $340 million dollars and creating about 11,495 jobs in Virginia Beach. The authors assert that an economic "echo" was created throughout the economies of both the region and the Commonwealth. They estimate that Virginia Beach's involvement in tourism result in a total of about 17,500 jobs and roughly $660 million in expenditures in the Hampton Roads MSA and a total of 19,000 jobs and roughly $680 million in expenditures in the Commonwealth. [The report is produced periodically.]

- Yochum, Gilbert R. and Agarwal, Vinod B. (1998). "Summer 1999 Virginia Beach Overnight Visitor Profile." Prepared for the Committee on the Value of Public Beaches, Bureau of Research, College of Business and Public Administration, Old Dominion University, Norfolk, VA.

Summary: The objective of this report is to provide useful information about the Virginia Beach tourist market to interested observers from private and public sectors. This study is based on a survey of a comprehensive set of topics including: tourist market area, demographic characteristics of visitors, visitor characteristics, visitors' spending pattern as well as information sources and plans of visitors. The major finding is that Virginia Beach continued to experience increasing visitor expenditures in the summer of 1999 despite a slight decline in hotel room nights. [This report is produced annually.]

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Linda Lent, Chrysalis Consulting, LLC, Bethesda, Maryland

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U.S. Army Corps of Engineers
Institute for Water Resources
Casey Building
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13. ABSTRACT (Maximum 200 words

This report reviews 100 studies and reports pertaining to the economic consequences of shoreline change and related issues. This document will serve as a resource for the National Shoreline Management Study (NSMS) and is the first step towards developing a comprehensive bibliography of literature relevant to assessing the economic impacts of shoreline erosion and accretion and to inform eventual NSMS recommendations on appropriate levels of Federal and non-Federal participation in shoreline protection at the NSMS completion. This literature search focused mostly on three topics for the NSMS: (1) market and policy incentives related to public and private shoreline use and management decisions, (2) identifying benefits and costs of shoreline protection, and (3) considering the fiscal impacts and financing of shoreline protection.

14. SUBJECT TERMS

National Shoreline Management Study, shoreline use, economic benefits, beach restoration and nourishment, storm events, legislation, shore protection, shoreline protection impacts and financing, project costs

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