

University of Massachusetts Amherst  
**ScholarWorks@UMass Amherst**

---

Travel and Tourism Research Association:  
Advancing Tourism Research Globally

2011 ttra International Conference

---

# Understanding Climate Change And Impacts On Tourism In The Outer Banks Of North Carolina

David L. Edgell PhD

*Department of Hospitality Management, College of Human Ecology, and Research Scholar Center for Sustainable Tourism, East Carolina University*

Carolyn E. McCormick

*North Carolina Climate Action Plan Advisory Group, Economic Development, Destination Branding*

Follow this and additional works at: <https://scholarworks.umass.edu/ttra>

---

Edgell, David L. PhD and McCormick, Carolyn E., "Understanding Climate Change And Impacts On Tourism In The Outer Banks Of North Carolina" (2016). *Travel and Tourism Research Association: Advancing Tourism Research Globally*. 76.  
<https://scholarworks.umass.edu/ttra/2011/Oral/76>

This is brought to you for free and open access by ScholarWorks@UMass Amherst. It has been accepted for inclusion in Travel and Tourism Research Association: Advancing Tourism Research Globally by an authorized administrator of ScholarWorks@UMass Amherst. For more information, please contact [scholarworks@library.umass.edu](mailto:scholarworks@library.umass.edu).

2011 ANNUAL TTRA CONFERENCE

**Understanding Climate Change And Impacts On Tourism In The Outer Banks Of  
North Carolina**

by

David L. Edgell, Sr., Ph.D.  
Professor of Tourism,  
Department of Hospitality Management  
College of Human Ecology,  
and Research Scholar  
Center for Sustainable Tourism  
RW-325 Rivers Building  
East Carolina University  
Greenville, NC 27858-4353 USA  
[edgell@ecu.edu](mailto:edgell@ecu.edu)  
Phone: 252-328-4962

Carolyn E. McCormick  
Advisor, Sustainable Tourism Consultant,  
North Carolina Climate Action Plan Advisory Group,  
Economic Development, Destination Branding  
114 Overlook Court  
Nags Head, North Carolina 27959 USA  
[carolynmccormick13@yahoo.com](mailto:carolynmccormick13@yahoo.com)  
Phone: 252-305-2203

## **UNDERSTANDING CLIMATE CHANGE AND IMPACTS ON TOURISM IN THE OUTER BANKS OF NORTH CAROLINA**

### **Introduction**

The changing global climate will pose profound policy challenges and demand strategic decisions from world leaders in coming decades. Climate variability has multiple dimensional impacts depending on the severity of the changes and the vulnerability of the area in question. Few industries are more dependent on the outcome of changes in climate than the tourism industry. For the future growth and sustainability of tourism in the United States, policy responses to climate change are critical. While this study is geared to impacts of climate change on tourism in the Outer Banks of North Carolina, much of the research and analysis contained herein has broad implications for similar coastal tourism destinations throughout the world.

The remarkable growth of tourism in the United States over the past 25 years has elevated the need for sustainable tourism policy discussions with respect to the repercussions of climate change on the tourism industry. “Largely as the result of growing concern about carbon emissions and resulting climate change, concern for the environment now occupies center stage in tourism (Goeldner, 2009, p. 576).” Becken and Hay (2007: xvii) state that, “Climate change will not only impact on tourism directly by changes in temperature, extreme weather events and other climatic factors, but also indirectly as it will transform the natural environment that attracts tourists in the first place – for example, by accelerating coastal erosion, damaging coral reefs and other sensitive ecosystems and by reducing snowfall and snow cover in mountainous regions. It will also affect the basic services that are so critical for tourism, such as water supplies, especially during periods of peak demand.” Dr. Patrick Long, Director, Center for Sustainable Tourism at East Carolina University suggests that, “We need to further our knowledge about climate trends.... impacts of variability and seasonality....and the development of policies and strategies to adapt to and mitigate effects of climate change (personal interview 2011).” Former United Nations World Tourism Organization’s Secretary General, Francesco Frangialli (2007) said “We {tourism industry} are part of the problem {global warming} and we will be part of the solution.”

Until recently, there existed limited research on the potential impact of climate change on specific tourism destinations in the United States. In a January 17, 2011 Associated Press article titled “Rising Sea Waters Threaten State’s Delicate Coastline” stated, “A North Carolina science panel is predicting the sea level will raise by 1 meter by 2100.” This report provides an up-to-date review of known facts about climate change relevant to the high-density tourist zone of the Outer Banks and promotes discussion of policy issues at the core of climate change

decision-making. Such research will help provide a policy agenda for climate change mitigation through sustainable tourism development and management in the United States.

Weather conditions and the climate of a tourism area often dictates why people travel, where they travel, how they travel, and when they travel and for how long visitors stay at the destination. What tourists want in their tourism products and destinations vary considerably. Generally visitors to beach areas are looking for sunshine and warm waters. Skiers and snowmobilers pray for good snow falls. Sightseers and outdoor recreationists hope for clear weather and moderate temperatures. The livelihoods of providers of visitor services at destinations are often dependent on a certain number of good weather days during the tourism season. Many tourism businesses have failed simply because of weather conditions. "...until we adequately address the issue of climate change, tourism managers will have to develop a comprehensive destination policy, strategy, and management framework that adapts to and accommodates the reality of long-term....climate change (Goeldner, 2009, p. 571)."

Variances in weather patterns due to climate change may have immediate repercussions on visitors. Forest fires destroy the flora and fauna of areas of interest to tourists. Hurricanes and tsunamis change coastlines and often wreck havoc on resort homes, destinations, and tourism services. Floods/droughts can decimate an area once dependent on tourism. All these concerns will determine the sustainability of tourism for the future.

Researcher Bill Birkemeier, Hydraulic Engineer at the U.S. Army Corps of Engineers Field Engineer Research and Development Center on the Outer Banks said that, "Over the past twenty years there has been a slight rise in both sea temperatures and sea levels due to climate change. Because the Outer Banks are dynamic and ever changing, and since sea-level rise is at present small and gradual, relative to twice-daily tidal variation and surges caused by frequent storms, it is difficult to determine what changes on the coastline are due directly to sea-level rise. A more immediate concern would be whether climate change may increase the number or severity of storms on the coast as storms have a major impact on coastlines."

Until global leaders aggressively address issues with respect to climate altercations, the tourism industry is left to its own devices to mitigate or adapt to consequences of such changes. (Edgell, et al, 2008: 351) mentions that, "Tourism administrators must undertake a paradigm shift away from overuse of natural resources toward environmental stewardship....Additionally, as global warming comes to the forefront in environmental concerns, tourism managers will need to stay attuned to forecast changes...." Individual regions must address the impact of climate change on their specific tourism destinations. If nothing is done, the future growth and sustainability of tourism will be at risk. If tourism stakeholders do not define clear-cut policies and plans at this juncture in the growth of tourism, there may never be another chance.

Understanding effects of climate change on tourism in the Outer Banks is critical to travel decision-making, environmental stewardship, social evolution, and the economic viability of the travel and tourism industry. Government at all levels and the travel and tourism industry are now more cognizant of the need to address efforts to sustain natural and built resources under changing climate conditions. Given the complexity and breadth of the current science of climate change on the tourism industry increases the need for research to effectively develop action plans in coastal areas. This study addresses a limited range of climate change issues with

respect to the Outer Banks tourism industry. However, this research may be useful in providing valuable information applicable to similar tourism destinations throughout the world.

## Literature Review

While climate change is increasingly becoming an area of interest in academic research and industry applicability, it still remains a relatively new phenomenon within the mainstream of the tourism industry (Viner and Becken 2003). Current literature suggests that the majority of scientists are in agreement that the world's climate is warming (IPCC 2007). What factors are causing this movement toward the changes in climate is an issue where there is considerable debate. Is it cyclical; is it caused by the actions of humans; is it endemic to the universe? Whatever the answer(s) climate change is proceeding at a rate in which there will be unavoidable impacts on the tourism industry. The economic impact alone from climate change on "beach recreation and tourism" is enormous (Bin, Poulter, and Whitehead 2007). Scott, McBoyle, and Mills (2003, p. 180), stated that "The current understanding of how recreational users and tourists respond to climate variability is very limited." The question is how the tourism industry will address the issues raised by this movement (Goeldner and Ritchie 2009). Mitigation policies or adaptation strategies and management actions will be an important part of any plan to reduce the impacts of climate change on the tourism industry.

Tourism is the major economic driver in the Outer Banks. The Outer Banks community must better understand that climate is changing and is having a serious impact on their coastal tourism and recreation economy. Local businesses and management authorities need to recognize the changes and make plans to adapt (Riggs, Culver, Ames, Mallison, Corbett, and Walsh 2008). The rich complexity of the Outer Banks, a dynamic group of barrier islands and coastline, provides a strong platform for discussion of mitigating impacts of climate change (Edgell, Sr. and McCormick 2008). The Outer Banks tourism industry is particularly sensitive to climate which can make or break the tourism businesses (Curtis, Arrigo, Long, and Covington 2009). A comprehensive research study reporting on the impacts of climate change on fish and wildlife in North Carolina (an important segment of the tourism industry), says, "Coastal wetlands are also highly vulnerable to sea level rise, and loss of this habitat has the potential to adversely affect a number of priority species..." along the Outer Banks (DeWan et al 2010). As properties in the barrier islands begin to disappear into the ocean, solutions become critical.

An article in *The Associated Press* (reproduced in *The Daily Reflector*, September 24, 2009) titled "Officials Cite Climate Change Threats in South" said that the U.S. Fish and Wildlife Service (Service) "...will try to save barrier islands, fight invasive species and work with companies to restore wildlife habitat as they confront the risks posed by climate change...." Sam Hamilton, Director of the U.S. Fish and Wildlife Service said, the Service "...is on the forefront of climate change threats and that coastal wildlife refuges from North Carolina....are endangered. We're seeing sea level rise issues, coastal erosion issues; we're seeing a lot of the sea turtle nesting beaches are stressed and absolutely disappearing". Since unique floral and faunal diversity are reasons why many visitors vacation in the Outer Banks, federal, state, and local agencies are concerned about the critical nature of climate change. Several universities throughout North Carolina, and elsewhere across the country, are investigating the impact of weather and other factors of the *mis en scène* of the Outer Banks. One leader in this effort is the

Center for Sustainable Tourism at East Carolina University (Center). This Center has sponsored numerous events and conducted studies to investigate climate change in the Outer Banks.

### **Research Method**

Studying climate change with respect to the Outer Banks is a connatural composite topic that is both controversial and often misunderstood. This lack of understanding, particularly with respect to local residents, is largely due to limited information available. This exploratory, qualitative study has utilized a modified Delphi approach as the principal instrument of investigation. The reasoning for using this research method is that an analysis of the combined experiences of tourism executives, experts from the North Carolina Climate Action Plan Advisory Group, sustainable tourism advocates from the Center, climate scientists, renewable energy experts, and marine conservationists presents ample data and comments to evaluate and better understand the impact of climate change on the Outer Banks tourism industry.

In the application of this modified Delphi approach facts and opinions were obtained from a wide variety of persons and groups who have studied and confronted the climate change issues or are otherwise interested in climate change impacts on the Outer Banks. Some of the members represent scientific and technical fields and others include business persons in the travel and tourism industry. It takes into account scientific work conducted by the Outer Banks Field Research Facility, U.S. Army Corps of Engineers, considered one of the finest national centers for measurements of coastal waters and climate change, as well as other research entities studying the Outer Banks coastal sustainability.

A first step in understanding climate change on tourism in the Outer Banks was to analyze the barrier islands and coastline. These dynamic coastal areas both retreat and accrete, with long term consequences. They act as buffers to protect the interior of the coast. The authors of this study have a long association with the Outer Banks business and technical community and have had full access to the published research regarding climate change impacts on tourism in the Outer Banks. In addition, they made an aerial reconnaissance to review and better understand the dynamics of the coastal changes. They also walked, or by auto traveled, the entire 130 miles of the Outer Banks, including the barrier islands, stopping along the way to gather additional personal comments and data from Outer Banks residents and visitors. Through discussions, interviews, meetings and by other means, the authors accumulated a large amount of published and unpublished facts and intelligence sources used throughout this research study. It also includes data and information available from North Carolina's Climate Action Planning Advisory Group (See Appendix for membership). This research, combined with studies not necessarily directed toward the Outer Banks tourism, along with comments from knowledgeable tourism executives, was included in the study.

Once the information was gathered, synthesized, and prioritized, further discussions took place with stakeholders, researchers, academics and others to obtain a general consensus of the perceived results of climate change on the Outer Banks. One science panel predicted that the sea level will rise by 1 meter by 2100. For the Outer Banks that could mean more than 2,000 square miles and adjacent environs would be at considerable risk. Because this area contains some of the most expensive real estate in North Carolina, there could be a \$7 billion shock to the residents. The Center for Sustainable Tourism and many other research entities are

continuing to conduct additional surveys, gathering new information, and seek to add additional dimensions to the study of climate change impacts on tourism at the Outer Banks.

### **Discussion and Implications**

The global tourism industry generates trillions of dollars in income, creates millions of jobs, and provides memorable experiences to individuals and families throughout the world. Tourism brings people and families together in both indoor and outdoor venues including the destination of the Outer Banks. Some visitors to this unique set of barrier islands represent generations of parents, children and grand children over a long period of time. The beautiful environmental coastline is a major reason why five million visitors from more than 50 countries visit the Outer Banks each year. More than half of the leisure travelers' to the Outer Banks participate predominately in beach activities. But, increasingly the importance of natural settings, the history and heritage of the area, and wildlife experiences are becoming important in family vacations to the Outer Banks.

In North Carolina tourism is a \$17.1 billion industry with employment at 190,000, and North Carolina's Outer Banks accounts for expenditures of over one billion dollars and 20,000 jobs. The visitors to the Outer Banks are most interested in the natural, cultural and historic resources; primarily the 130 mile stretch of beaches of the Outer Banks. The Outer Banks are truly "America's Beach"; free and open access chains of barrier islands off the northeastern coast of North Carolina. A study (Bin el al 2007) on "Measuring the Impacts of Climate Change on North Carolina Coastal Resources," suggests that if climate change takes place resulting in more storms the Outer Banks will lose millions of dollars in lost revenue from tourists and recreationists. In fact the sea is already rising along the coast and changes in wildlife patterns have been observed.

Nearby to the Outer Banks are many attractions such as the Fort Raleigh National Historic Site, birth place of English speaking America in 1587; Wright Brothers National Memorial, home of man's first powered flight in 1903; Cape Hatteras National Seashore Recreation Area, the Nation's first national seashore established in 1953; Pea Island National Wildlife Refuge; and Alligator River National Wildlife Refuge; all are integral parts of visitor interest in the Outer Banks. Seventy percent of the dynamic barrier islands are owned by the people of the United States and managed by the United States Department of the Interior.

Climate change presents a special challenge to the Atlantic Ocean coastline of the Outer Banks. Weather and climate fluctuations in the Outer Banks region have tremendous impacts on the economic vitality of the area. Tourism is the most important economic activity for the Outer Banks, increasing economic development, realizing increased revenues, creating new jobs, benefiting from a diverse economy, adding new products, generating additional income, spawning new businesses, and contributing to overall economic integration. Economic success in tourism on the Outer Banks is measured by the ability to attract visitors' year around, not just during the more traditional tourist season. While climate change plays a major role in this industry, just the *perception* of weather conditions as presented by the media impacts heavily on the tourism decisions by visitors.

As mentioned earlier, the Outer Banks are “dynamic”. The coastal zone of today is not permanent and will continue to change as it has in the past. It is the fragile fixed human infrastructure that can easily be destroyed by natural processes and climate change. This is a principal reason our coasts are in crisis. In addition, it is important to understand that the Outer Banks area is incredibly varied, with rivers, swamps, estuaries, marshes, barrier islands, inlets, beaches and off shore shoals and rock. If the warming climate spawns more frequent and intense hurricanes and other storms, the future will see coastal erosion and associated loss of urban infrastructure, wetlands, and wildlife habitats. Despite the growing knowledge about, and interest in climate change by a wide variety of interested parties, there appears to be a continuance of a “business as usual” attitude by many coastal destination managers. The question remains as to the best methods for communicating the impact of climate change with the local businesses and communities. Communication through emails, FAQ sheets, blogs, Internet, university programs, governmental data, and community meetings are, in addition to research, ways in which scientists, both physical and social, can help the general public better understand climate change on tourism.

The negative effects of climate change on the Outer Banks have recently been exacerbated by the fact that so many new residents are moving into the area. Such a phenomenon means the area is being inundated by enormous amounts of infrastructure. This wreaks havoc on the natural environment and sets the stage for an even greater crisis as the climate changes. As the climate gets warmer and more frequent and intense storms take place, it becomes more difficult to evacuate tourists and residents during such crises. Since the barrier islands called the Outer Banks change and physically move as a result of the storms, what might have seemed possible to alleviate negative impacts one day may not work in the future.

The question is not whether the Outer Banks climate is changing but rather how to prepare the communities along the coastline for the future. How will we be able to protect the native plant and animal species? The very way of life for Outer Banks residents is closely tied to the climate. Beaches are already shrinking. Homes are being lost to the sea. Properties are being flooded. More frequent high waves will damage formerly untouched areas. Coastal wetlands may disappear. If the area environment declines, there will be fewer visitors and the economy will suffer. Coastal erosion and related damage will become commonplace. The natural sand dunes already have been heavily destroyed or altered. Fish and bird life dependent on wetlands will not have their natural habitat. If the heat becomes more intense, public health will be at risk, especially that of children and the elderly. These are all issues for discussion. The implications from such changes are mind boggling. These concerns are a wake-up call for action. Citizens, businesspersons, and political leaders in the community must develop plans of action. Our children and grandchildren are dependent on community action today so they will be able to enjoy the beautiful Outer Banks tomorrow.

It is clear that climate change is a serious threat to humans, fish, and wildlife in the Outer Banks. In response to this threat efforts to sustain natural resources under changing climate conditions must be forthcoming before it is too late. Otherwise the negative effects of climate change will decrease the quality of life for all concerned. Climate change is a complex set of situations and can be challenging to understand, but good communications, management, planning, and policies can move the community in a positive direction and



alleviate some of the pressure on future climate change in the Outer Banks. This study confirms an urgency to develop policy guidelines and promote long term planning to offset negative effects of climate change and move forward to conserve and protect resources for the future.

## Conclusion

As noted throughout this study, few industries are more dependent on an understanding of climate change than tourism. Tourists have many choices with respect to locations and activities and climate plays an important role. Today, visitors not only visit the Internet to view the destination they are interested in, but also Google the weather reports for the area and then make a decision on where they want to spend their holiday.

Paradoxically, global climate change may not be totally negative to beach tourism; certain coastlines may be able to extend their seasons due to higher water and air temperatures. Regardless, the tourism industry must better understand the interactions of climate change and tourism and respond with responsible plans and policies. In the meantime, mitigation policies and actions to reduce greenhouse gas emissions that contribute to global warming must continue if the long term impacts of climate change are to be manageable.

The Outer Banks of North Carolina, particularly the barrier islands, is disproportionately affected with respect to the climate change impacts on tourism and beachfront real estate. Beach erosion near vacation homes and businesses is already critical with, for example, more than 109 properties recently lost and 39 currently in peril along one two mile stretch of the beach. Loss of wildlife habitat (due to erosion and the increasingly close link between the land and near shore waters causing decreased water quality) is already at a critical stage. Climate changes affect the quality of the environment, the experience of tourists, wildlife, and, the very sustainability of these barrier islands. The potential economic and social consequences could be devastating.

In the long-term, successful mitigation policies may stem the tide with respect to global warming and climate change. With respect to the present, we no longer have the luxury of debate. The impact of climate change on the Outer Banks is now and it is necessary to work toward immediate climate change adaptation strategies. Based on the research contained in this report, and after participating in many different meetings and planning sessions with stakeholders along the Outer Banks, the authors concluded that at the very least, a coordinated strategic plan to adapt to climate change should include the following guidelines:

- Assure maintenance of a safe and secure recreational environment
- Examine the need for beach restoration, including beach renourishment (For example in Nags Head in the Outer Banks, the community implemented a tax increase to generate \$36 million for beach nourishment that begins in July, 2011)
- Study if harden structures along coastline: jetties, groins, seawalls are needed
- Work toward sound policies for wildlife and habitat conservation
- Protect the built environment: history, heritage, and culture of the area
- Develop educational/awareness programs to explain climate change impacts

- Keep abreast of new research on climate trends
- Advocate good waterway and coastal management practices
- Regularly check the health of ecosystems
- Provide developers and agencies with risk assessments to guide development
- Encourage communications and coordination amongst all interested parties
- Review opportunities for resource savings with respect to energy
- Improve data collection and share results with local, state, and national offices
- Be willing to help develop, monitor, and test climate change models

While discussions and controversy about climate change may arise over how best to utilize these guidelines or to make other changes, businesses, developers, tourists, local communities, state and federal agencies, not-for-profit entities, and educational institutions all have a stake in working together toward a healthy, safe, and well-managed coastal environment. If it is not understood now, the stakeholders and community will lose in the future. The Outer Banks waterways and coastline is an excellent but fragile laboratory to study climate change and to convince those engaged in coastline activity that now is the critical time period for action. It is clear from the research in this report that climate changes and rising water levels could have a tremendous and devastating impact on tourism in the Outer Banks. Researchers, businesses, and government agencies in the Outer Banks are only recently cooperating more and developing strategies and new ideas to respond to climate change and storm severity. Tourism stakeholders are beginning to understand the need for long-term management of resources and to seek solutions in order to cope with the impact of climate change on tourism in the future.

In summary, the issue of climate change, and its impact on tourism, is being researched as a potential local security threat to the beautiful Outer Banks area that welcomes millions of visitors each year. These visitors arrive by carbon-spewing automobiles and use up energy resources but tourism leaves millions of dollars in revenue. Tourists, residents and public officials don't always understand that their actions have a major bearing on the future sustainability of the area. The question is how to find the right balance; tourism and the environment are not mutually exclusive. The ultimate goal is to preserve the Outer Banks such that future generations of visitors to the Outer Banks can enjoy their vacation and the local residents will have a better quality of life and that the natural resources and wildlife will be conserved and protected.

###

## References

- Amelung, Bas, Sarah Nicholls, and David Viner (2007). "Implications of Global Climate Change for Tourism Flows and Seasonality." *Journal of Travel Research*, 45: 285-96.
- Becken, Susanne, and John E. Hay (2007). *Tourism and Climate Change: Risks and Opportunities*. Clevedon, England: Channel View Publications.
- Becken, Susanne, and David Viner (2003). "Climate Change Mitigation Policies and the Global Tourism Industry." *Climate Change Management*, December 12, 2003.
- Bin, O., C. Dumas, B. Poulter, and J. Whitehead (2007). "Measuring the Impacts of Climate Change on North Carolina Coastal Resources." National Commission on Energy Policy. March 2007, Washington, D.C.
- Birkemeier, Bill (2008). U.S. Army Corps of Engineers, Engineer Research and Development Center, Duck, North Carolina. Personal Interview, November 5, 2010.
- Center for Sustainable Tourism "Climate, Weather, and Tourism Workshop: Issues and Opportunities," November 14-15, 2008. Greenville, North Carolina: East Carolina University.
- Christ, Costas (2011). "As the World Sinks: A Message in a Bottle from the Maldives." In *National Geographic Traveler*, March 2011, pp. 22-23, Washington, D. C.
- Curtis, Scott and Jennifer Arrigo, Patrick Long, and Ryan Covington (2009). "Climate, Weather and Tourism: Bridging Science and Practice." Greenville, North Carolina: Center for Sustainable Tourism, East Carolina University.
- De Freitas, Chris R. (2005). "The Climate-Tourism Relationship and its Relevance to Climate Change Impact Assessment." In *Tourism Recreation and Climate Change*, edited by Colin Michael Hall and James E. S. Higham. Clevedon, UK: Channel View, pp. 29-43.
- "Deloitte Survey and White Paper Highlight the Growing Role of the Board in Corporate Responsibility, Sustainability and Climate Change." (2 March, 2009) *U.S. Newswire*.
- DeWan, Amielle and Natalie Dubois, Kathleen Theoharides, and Judith Boshoven (2010). *Understanding the Impacts of Climate Change on Fish and Wildlife in North Carolina*. Washington, D.C.: Defenders of Wildlife.
- Edgell, Sr., David L. (2005). "Sustainable Tourism as an Economic Development Strategy for the Waterways and Coastline of North Carolina." A North Carolina Sea Grant Study,

Greenville, North Carolina.

- Edgell, Sr., David L. (2006). *Managing Sustainable Tourism: A Legacy for the Future*. New York, New York: The Haworth Hospitality Press, Inc.
- Edgell, Sr., David L. and Ginger Smith, Jason R. Swanson, and Maria DelMastro Allen (2008). *Tourism Policy and Planning: Yesterday, Today and Tomorrow*. London, England: Elsevier.
- Frangialli, Francesco (2007). Keynote Address: "Tourism Can Help in Global Action on Climate Change and Poverty", Bali, Indonesia, December 13, 2007.
- Goeldner, Charles R. and J.R. Brent Ritchie (2009). *Tourism: Principles, Practices, Philosophies* (Eleventh Edition). Hoboken, New Jersey: John Wiley & Sons, Inc.
- Hall, Colin Michael, and James E. S. Higham (2005). "Introduction: Tourism, Recreation and Climate Change." In *Tourism Recreation and Climate Change*, edited by Colin Michael Hall and James E. S. Higham. Clevedon, UK: Channel View, pp3-28.
- Intergovernmental Panel on Climate Change (2007). *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge, UK: Cambridge University Press.
- Kerr, Richard A. and Eli Kintisch (2010). "Climatologists Feel the Heat As Science Meets Politics." *Science*, Vol. 330, December 17, 2010.
- Long, Patrick (2009). Personal quotation given on February 18, 2009, Center for Sustainable Tourism, East Carolina University, Greenville, North Carolina.
- McCool, Stephen F. and R. Neil Moisey, Editors (2008). *Tourism, Recreation and Sustainability* (2<sup>nd</sup> Edition). Cambridge, Massachusetts: CABI International.
- McCormick, Carolyn E. (2009). Testimony before the U.S. House of Representatives, Committee on Natural Resources Oversight Hearing: "Perspectives on the Outer Continental Shelf", February 11, 2009.
- Riggs, Stanley (2008). "Climate and Weather Trends Impacting North Carolina's Tourism." Climate, Weather, and Tourism Workshop, November 14-15, 2008. Center for Sustainable Tourism, East Carolina University, Greenville, North Carolina.
- Riggs, S. R. and S.J. Culver, D.V. Ames, D.J. Mallison, D.R. Corbett, and J.P. Walsh (October 2008). "North Carolina's Coasts in Crisis: A Vision for the Future." Greenville, North Carolina.

Scott, Daniel, Geoff McBoyle, and Brian Mills (2003). "Climate Change and the Skiing Industry in Southern Ontario (Canada): Exploring the Importance of Snowmaking as a Technical Adaptation." *Climate Research*, 23: 171-81.

*The Daily Reflector*, September 24, 2009 article "Officials Cite Climate Change Threats in South" (repeated from an article from *The Associated Press*).

## APPENDIX A

### North Carolina Climate Action Planning Advisory Group – Members

Stan Adams, *NC DENR, Division of Forestry Resources (now retired, but active)*  
Dan Besse, *Winston-Salem City Council*  
Ryan Boyles, *State Climatologist, NC Climate Office*  
Thomas F. Cecich, *Environmental Management Commission*  
Caroline Choi, *Progress Energy*  
Jerry Coker, *Weyerhaeuser*  
Marion Deerhake, *Environmental Management Commission*  
Dolores M. Eggers, *Professor, UNC Asheville*  
Roy Ericson, *NC Utilities Commission*  
George Everett, *Duke Energy*  
George Givens, *Principal Legislative Analyst, Attorney at Law, General Assembly of North Carolina, Council to the Environmental Review Commission of the General Assembly of North Carolina and the Legislative Commission on Global Climate Change*  
Dennis Grady, *Appalachian State University*  
Steve Halstead, *NC Council of Churches*  
Bob Hazel, *Senior Citizens' Interest*  
Dennis Hazel, *NCSU, Forestry Extension*  
Alex Hobbs, *NCSU Solar Center*  
Bill Holman, *Clean Water Management Trust Fund, Duke University, Nicholas Institute for Environmental Policy Solutions*  
Preston Howard, *Manufacturer Chemical Industry Council*  
Gary Hunt, *NC DENR Division of Pollution Prevention and Sustainability*  
Robert Jackson, *Duke University, Nicholas School of the Environment and Earth Sciences*  
Robert Koger, *Advanced Energy*  
Carolyn E. McCormick, *former CEO Outer Banks Visitors Bureau*  
Steven McNulty, *USDA Forest Service, Southern Global Change Program*  
Maximilian Merrill, *NC Department of Agriculture and Consumer Services*  
Marilyn Nixon, *Southern Environmental Law Center*  
Chuck Pickering, *Biltmore Estate*

Simon Rich, *Energy Industry & Duke University*  
Lisa Riegel, *NC Natural Heritage Trust Fund*  
Roger Sheats, *Global Warming Initiatives*  
Paul Sherman, *NC Farm Bureau (replaced Mitch Peele)*  
Larry Shirley, *State Energy Office, NC Department of Administration*  
Michael Shore, *Environmental Defense*  
Bob Slocum, *North Carolina Forestry Association*  
Libby Smith, *NC Department of Commerce*  
Stephen Smith, *Southern Alliance for Clean Energy*  
Jim Stephenson, *NC Coastal Federation*  
Nina S. Szlosberg, *NC Board of Transportation*  
Tim Toben, *Carolina Green Energy*  
Ivan Urlaub, *NC Sustainable Energy Association*  
Kraig Westerbeek, *Murphy-Brown Farms*  
Stephen Whitfield, *NC Woodlands*  
Jim Witkowski, *International Paper (replaced Edward Krue)*  
Skip Yeakel, *Volvo Trucks North America*