

UNC System Coastal and Marine Science Activities Self-Study: Western Carolina University

I. Overview of the University

Western Carolina University has one coastal and marine science activity: The Program for the Study of Developed Shorelines.

Organizational Chart: The Director of the Program for the Study of Developed Shorelines (PSDS) reports directly to the Provost of Western Carolina University. The center is a collaborative effort with the Duke University's Nicholas School of the Environment where the center was founded in 1985.

Narrative:

The Program for the Study of Developed Shorelines differs academically and financially from other Centers being examined in the system-wide self-study. Academically, the PSDS neither grants degrees, nor competes with other UNC units for students, majors, or academic courses. WCU does not have a Marine Science Program, nor an intention to develop one in the future. The Program for the Study of Developed Shorelines does contribute rich interdisciplinary learning opportunities for students across campus as detailed later in this report. Financially, the PSDS is funded entirely through institutional sources in addition to significant contributions from competitive research grants. The PSDS does not rely on any other state or federal funds for its base budget. The staff includes two faculty lines funded by WCU and three other research/program positions funded entirely by grants and contracts.

The Program for the Study of Developed Shorelines meets many of the strategic goals outlined in WCU's strategic plan, 2020 Vision: Focusing Our Future, endorsed in June, 2012 by the WCU Board of Trustees. For example, Initiative 1.1.6 calls for the university to "Identify and develop integrated, cross-disciplinary centers/institutes of study and outreach, where appropriate, based on the curricular focus areas." The PSDS is a cross-disciplinary center having documented interaction with faculty and students in multiple colleges and multiple programs including geosciences, biology, chemistry, natural resources, political science, public policy, history, emergency management, film, and art. PSDS personnel teach courses in three different programs at the undergraduate and graduate level. In addition, the WCU 2020 Strategic Plan also calls for enhanced collaboration with external entities making WCU a "hub of innovation" (Initiative 1.1.2: 5). In the course of carrying out projects of regional, national, and international importance, PSDS partners regularly with three Federal agencies: National Park Service, National Oceanographic and Atmospheric Administration, and United States Geological Survey; dozens of non-governmental organizations; and many private entities.

WCU's 2020 Strategic Plan also calls for WCU to "assume regional leadership in the study of the environment and environmental policy" (Initiative 1.1.2:3), a goal which aligns with the explicit mission of the PSDS. Personnel of PSDS have received competitive research grants for environmental science projects and are centered on translating science into policy, management, and education. The PSDS center has received WCU's largest National Science Foundation grant (\$1.5 Million), as well as grants from the National Park Service that concentrate entirely on environmental management and planning. This integrated work makes the center unique, valuable, and pertinent to WCU's academic and regional mission in serving our students, the environment, and external collaborators.

A critical component of WCU's strategic vision for the future includes the "expectation for experiential and applied learning opportunities, including undergraduate research opportunities" (Initiative 1.3.2). This is where PSDS excels in serving the WCU community. Over the last five years:

- PSDS researchers have published professional papers and abstracts with over 70 students as co-authors;
- PSDS has paid wages to 54 undergraduates assisting with grant-funded research projects;
- PSDS personnel have taken hundreds of students on field trips while covering all the costs.

Finally, WCU's 2020 Strategic Plan calls for a strengthening of "relationships and communication between the University and its external partners" in the region (Goal 3.1), and in this regard, the PSDS has proven to be much more than just a "coastal" center: PSDS researchers have a strong, applied research presence in the mountains. For the last five years, PSDS has engaged in an important partnership with the Eastern Band of the Cherokee Indians (EBCI): *The Rivercane Research Project*. Initially funded by the Cherokee Preservation Foundation, the PSDS has worked closely with the EBCI to perfect the state of the science of native rivercane restoration. The project has resulted in three peer-reviewed journal articles and dozens of presentations at meetings. Currently, we are overseeing a major rivercane restoration at the new Cherokee school where we will be working with teachers to involve students in the science of rivercane restoration (primarily used in Cherokee basket-making). The project has brought much good will and good press locally. This past summer, PSDS was presented an Award for Excellence for its work with Native American young people in incorporating diversity into environmental science education.

Western Carolina University continues to support the activities of the Program for the Study of Developed Shorelines not because the center has a coastal and marine science element, but rather because the center already meets so many of the key goals embraced in the 2020 Strategic Plan. Because the precise focus of the research is somewhat academic, PSDS is a center of academic excellence that brings significant, positive attention to the university, provides important educational opportunities for WCU students, and contributes to the overarching mission and goals of the university.

WCU has no plans to expand its coastal and marine science activities beyond the current role PSDS plays at the university, in the state, and nationally.

II. Coastal and Marine Science Activities

A. Activity: (Program for the Study of Developed Shorelines)

B. Activity Narrative

Mission: PSDS serves as the nation's primary nexus between coastal science and policy. PSDS seeks grant funding to apply innovative approaches to studying and understanding coastal processes, as well as translating new coastal science into sensible, science-based management recommendations. The center also seeks to communicate this science to the general public through traditional and non-traditional outlets.

History: The Program for the Study of Developed Shorelines (PSDS), founded at Duke University in 1985, moved to Western Carolina University in 2006 in response to a direct appeal from then President Erskine Bowles to the units of the UNC System to develop lines of collaboration with Duke University in the Marine Sciences. At that time, Dr. Rob Young, a faculty member in the Geology Program at WCU, was considering the position of Director of PSDS at Duke. Rather than Dr. Young moving to Durham, then WCU Provost Kyle Carter and William Schlesinger (Dean of the Nicholas School of the Environment at Duke) negotiated a move of the assets of PSDS to WCU, while maintaining a long-term collaboration with Duke. This collaboration remains today. PSDS's main offices, research library, and all intellectual property have transferred to WCU under the Direction of Dr. Young. PSDS maintains an auxiliary office at Duke run by Orrin H. Pilkey (PSDS founder and James B. Duke Professor Emeritus), and Dr. Young is an Adjunct Professor in Earth and Ocean Sciences at Duke. Duke University regularly provides Stanback Fellows as summer interns who live and work in Cullowhee at no cost to PSDS. WCU faculty continue to publish jointly with Duke faculty, and the collaboration has been fruitful and meaningful.

The Program for the Study of Developed Shorelines conducts scientific and policy research on many issues of coastal management that are not touched by other researchers, programs, or centers in the state. For example, PSDS maintains the nation's only beach nourishment project database, which is frequently cited by researchers and media alike. PSDS staff are building, in collaboration with NOAA, the nation's first comprehensive database of storm surge measurements. This database will have online and smart phone access for use by emergency managers, scientists, and the media. The center regularly provides review of coastal engineering project design for local communities and NGOs. PSDS staff provides unparalleled expertise in evaluating the science, modeling, and fiscal analysis of these projects. The center maintains one of the nation's largest libraries of unpublished, coastal project design documents.

PSDS has seen significant, national collaboration with the National Park Service over the last five years. The center has developed a manual for monitoring geologic change in all national parks (published by the Geological Society of America). The center is currently developing guidelines that will be used to assist all national seashores in planning long-term adaptation to sea level rise and storms (particularly important for Cape Hatteras and Cape Lookout National Seashores in North Carolina). PSDS researchers are also currently funded to create a detailed list of every National Park asset at risk to coastal erosion and sea level rise over the next 100 years. These are clear examples of the PSDS mission: using science to impact coastal management and serve the public interest. This work has little overlap with projects conducted at other UNC system units.

Additionally, PSDS maintains several important local research projects which complement the center's involvement in environmental restoration and modern landscape evolution. PSDS staff has guided a 7-year long Rivercane Restoration Project in collaboration with the Eastern Band of the Cherokee Indians. Researchers have also participated in projects examining the evolution of mountain heath balds and wetlands in the southern Appalachian mountains. In collaboration with other faculty at WCU and UNC-Wilmington, PSDS has participated in and funded research into the Holocene climate in the southern mountains, a project which resulted in the submission of an article to the journal *Science*.

Another unique and compelling aspect of the Program for the Study of Developed Shorelines is the significant presence the center has in the popular media, and thus the visibility of important and ongoing research activities at WCU:

- 1) In the last five years, PSDS staff have been quoted or mentioned in more than 150 print media outlets including: *The New York Times*, *Wall Street Journal*, *USA Today*, *Smithsonian Magazine*, *National Geographic*, *Scientific American*, *Newsweek*, *Popular Mechanics*, *Discover*, *La Liberacion*. PSDS does not track the smaller media outlets, but there have been hundreds as well. Of particular note was an article in *Smithsonian Magazine* from December 2011 which featured a detailed description of a five-year, National Science Foundation funded project that PSDS has been running in Washington State.
- 2) In the last five years, PSDS staff have written under a WCU byline invited guest commentaries and articles in more than 50 print media outlets including: *The New Your Times* (3), *USA Today*, *The News and Observer*, *Architectural Monitor*, *The Atlanta Journal*, *The New Orleans Times Picayune*.
- 3) In the last five years, Dr. Rob Young, as Director of PSDS, has made numerous appearances on international television and radio, ranging from NPR's *Morning Edition*, *Anderson Cooper*, and *PBS NOW*, to a full-length documentary for French television.

The ability to communicate science and policy to the general public truly makes the center unique, not just in North Carolina, but nationally. An indication of the stature of the center in the eyes of the national media occurred as this document is being written. As Hurricane Sandy dissipated over the northeastern US, Glen Nishimura, editorial page editor for *USA Today* personally solicited an Op Ed from the PSDS regarding the lessons to be learned from the hurricane (article ran Nov. 2, 2012).

Impacts: Center personnel have played a significant role in raising and addressing a large number of coastal management issues on a national and local basis. PSDS faculty have:

- Testified before Congress and state legislatures
- Served on state advisory bodies in multiple states including North Carolina
- Participated in the current National Climate Assessment
- Served on panels guiding federal government coastal policy and guiding federal science
- PSDS is leading the National Park Service's efforts to plan for rising sea level

- PSDS has also become a leader in bringing geoscience education to Native American young people in North Carolina and nationally.

Challenges and the Future: The next year for the Program for the Study of Developed Shorelines is reasonably secure. Activities and personnel are well-funded through the next two years. The center will need to continue to fund all soft money positions through competitive grant writing. PSDS has a

good track record, but grant writing will need to remain a continued focus and priority for the center Director.

The future of the Program for the Study of Developed Shorelines at Western Carolina University is strong. The center has required relatively little institutional funding while generating significant grant funding through a variety of competitive sources. There is no need for additional infrastructure or expansion of center staff or facilities. The center Director is currently working with the WCU Development Office to build a plan for the development of an endowment to fund future activities and further reduce the institutional contributions currently made to PSDS.

C. Resources

1. Personnel

- a.) The Program for the Study of Developed Shorelines is also advised by a group of internationally recognized Distinguished Fellows. The list can be found at <http://www.wcu.edu/26472.asp>

Table C1. Personnel

Name	Title	Role
Robert Young	Director and Professor of Geosciences	Center leadership
Andrew Coburn	Associate Director	Development of coastal management
Holli Thompson	Program Manager	Financial management
Katie Peek	Research Scientist	Grant-funded research
Adam Griffith	Research Scientist	Grant-funded research

- b.) PSDS is not a degree-granting program, and WCU does not have a graduate program in the Geosciences. PSDS personnel impact the education of hundreds of undergraduates every year through a variety of ways described elsewhere.

2. Funding

All non-institutional funds are from competitive grants which vary from year to year. Expenses also vary from year to year based on the nature of the funded projects in which PSDS is engaged. Outstanding grant proposals will likely increase FY13 revenues. Because much of the PSDS budget comes from grant sources and multiyear grants, FY14 revenue total is difficult to project.

Table C2: Revenue

Source	FY10 (\$)	FY11 (\$)	FY12 (\$)	FY13 (\$) Current	FY14 (\$) Projected
Federal	665,994	553,647	464,905	231,693	300,000
State (not including university)	NA	NA	NA	NA	NA
Institution (e.g. University)	231,125	232,572	212,741	214,762	214,762
Foundation	69,768				
Other*	8,893	7,100	8,300	5,000	15,000
Total	975,780	800,521	688,776	456,362	529,762

Table C3: Expenses: May not balance revenues in any given year because multi-year grants carry over.

Source	FY10 (\$)	FY11 (\$)	FY12 (\$)	FY13 (\$) Current	FY14 (\$) Projected
Personnel	405,807	411,259	397,560	64,650	400,000
Programmatic	452,103	409,911	346,144	82,832	130,000
Physical infrastructure	4,800	7,400	5,000	---	---
Maintenance and operation	61	161	---	---	---
Equipment (>\$5,000)	---	9,702	---	---	---
Other Direct Costs*	1,200				
Indirect Costs	86,687	26,236	36,138	8,658	20,000
Total	950,658	864,669	784,842	156,140	550,000

3. Physical infrastructure

One large office space on the WCU campus in the Belk Building. One small laboratory space on the WCU campus, adjacent to the Belk Building.

D. Research, Teaching, Public and Professional Service

1. Research

In the table below, currently funded research projects (extramural and intramural) are listed and describe title, investigators, dollar amount, and time frame. REACH NC Appendix also provides additional information in response to this question.

Table D1. Research

<i>Project title</i>	<i>PI/CoPIs – include institution</i>	<i>Sponsor</i>	<i>Amount</i>	<i>Dates</i>
Elwha Science Education Project	Robert S. Young	National Science Foundation	\$1,500,000	June 2007 – June 2103
Coastal Adaptation in Coastal Parks	Robert S. Young	National Park Service	\$274,500	Sept 2011- Nov 2013
Building a National Storm Surge Database	Robert S. Young	NOAA	\$1,484,218	Aug. 2008- Aug 2013

2. Teaching and Instruction (if applicable)

a.) No courses are taught as a direct result of, or in support of, this activity. PSDS personnel do teach a wide variety of courses in multiple departments, but these are WCU courses which existed in the curriculum before the center moved to WCU.

b.) Not Applicable

c.) Public Service, Outreach and Community Engagement

All members of PSDS staff have given dozens of invited presentations to a wide variety of public entities over the last five years including municipal governments, homeowners' groups, civic groups, NGOs, universities, and schools.

Over the last five years PSDS has provided *pro bono* coastal consulting to the following entities: The Nature Conservancy, The Surfrider Foundation, The Sierra Club of North Carolina, The Town of North Topsail Beach, the Town of Sunset Beach, The North Carolina Coastal Federation, The South Carolina Coastal Conservation League, The South Carolina Environmental Law Project, The Conservation Law Foundation, Taxpayers for Common Sense, The National Park Service, The Government of Montserrat, and more.

Table D4. Public Service, Outreach and Community Engagement

<i>Public Service / Outreach/Engagement program name and brief description (one sentence)</i>	<i>Dates</i>	<i>Personnel Involved</i>	<i>Participants in program (e.g. K-12 teachers)</i>	<i>Number of participants</i>
Elwha Science Education Project	June 2007-present	Robert S. Young Holli Thompson	7-12 grade Native American Students	310 over five years
Rivercane Restoration at Cherokee School	2011-present	Adam Griffith Robert S. Young	k-12 students and teachers	40

a.) Professional Service

Table D5. Professional Service

<i>Board or Group name</i>	<i>Dates</i>	<i>Activity member name & affiliation</i>	<i>Service provided</i>
Science Advisory Panel to the NC Coastal Resources Commission	2006 - present	Robert S. Young	Member
South Carolina Blue Ribbon Commission on Shoreline Change	2011 - present	Robert S. Young	Member
Naturebridge Olympic	2009-present	Robert S. Young	Board Member
<i>Journal of Coastal Research</i>	1998-present	Robert S. Young	Editorial Board
<i>Environmental Geosciences</i>	1999-present	Robert S. Young	Editorial Board
NC Legislative Commission on Offshore Drilling	2009	Robert S. Young	Member

Geological Society of America	2002-2011	Robert S. Young	Director, Technical Program GSA Annual Meeting
Geological Society of America	2006-2010	Robert S. Young	Public Policy Committee
National Climate Assessment	2012	Robert S. Young	Working Group Member
Nature Conservancy	2008-present	Robert S. Young	SLR Adaptation Advisory Panel
Geological Society of America	2010-2011	Robert S. Young	Chair, Annual Program Committee
Public Laboratories	2011-present	Adam Griffith	Founding Board Member

E. Outputs and Impacts

1. Publications

Refereed:

- Russell S. Vose, Scott Applequist, Mark A. Bourassa, Sara C. Pryor, Rebecca J. Barthelmie, Brian Blanton, Peter D. Bromirski, Harold E. Brooks, Arthur T. DeGaetano, Randall M. Dole, David R. Easterling, Robert E. Jensen, Thomas R. Karl, Richard W. Katz, Katherine Klink, Michael C. Kruk, Kenneth E. Kunkel, Michael C. MacCracken, Thomas C. Peterson, Karsten Shein, Bridget R. Thomas, John E. Walsh, Xiaolan L. Wang, Michael F. Wehner, Donald J. Wuebbles, and Robert S. Young (In Press) Monitoring and Understanding Changes in Extremes: Extratropical Storms, Winds, and Waves. *Bulletin of the American Meteorological Society*, 5p.
- Peek, Katie L and Young, R. S. (In Press) Building a national storm surge database. *Journal of Coastal Research*, 9p.
- Coburn, A. S., 2012. Beach Nourishment in the United States. In J. Cooper & O. Pilkey (Eds.), *Pitfalls of Shoreline Stabilization* (pp. 105-119). Heidelberg: Springer.
- Stanchev, H., Young, R., Palazov, A., and Stancheva, M. (2011) GIS as a tool to study and preserve sand dunes (Bulgarian Coast). *CoastGIS2011*, 3: 8-15.
- Tanner, B.R., Kinner, D.A., Griffith, A.D., Young, R.S. and Sorrell, L.M. (2011) Presence of *Arundinaria gigantea* (rice cane) on numerous non-wetland sites suggests improper ecological classification of the species. *Wetlands Ecology and Management*, 19(6): 521-532.
- Mathews, K. G., J. Huguelet, M. Lanning, T. Wilson, and R. S. Young. (2009) Clonal diversity of fruiting culms within stands of *Arundinaria gigantea* (Poaceae; Bambusoideae) in western North Carolina assessed using AFLP fingerprints. *Castanea*, 74(3): 213-223.
- Griffith, A. D., Kinner, D. A., Tanner, B. R., Moore, A., Mathews, K. G., & Young, R.S. (2009). Nutrient and Physical Soil Characteristics of River Cane Stands, Western North Carolina. *Castanea*, 74(3): 224-235.
- Bush, D.M. and Young, R.S. (2009) Coastal features and Processes, *In* (R.S. Young and L. Norby eds.) *Geologic Monitoring*, Geological Society of America. Boulder, pp 47-67.

Young, R.S. (2008). The importance of carbon loss through wetland erosion in the Albemarle-Pamlico-Currituck Sound system, North Carolina. *Southeastern Geology*, 45:2:51-58

Other:

Young, R.S. and Norby, L.S. (2010) *Geologic Monitoring*. Geological Society of America, Boulder, CO. 255p

Pilkey, O.H. and Young, R.S. (2010) *The Rising Sea*. Island Press, New York. 187 pp.

Coburn, A.S. , Griffith, A.D. and Young, R.S. (2010) Inventory of Coastal Engineering Projects in Coastal National Parks. National Park Service, Natural Resource Technical Report NPS/NRPC/GRD/NRTR-2010/373. 138pp.

Pilkey, O.H., Young, R.S., Coburn A.S. (2012) Rethinking Living Shorelines. Program for the Study of Developed Shorelines. White Paper. Cullowhee, NC. 10pp.

Coburn, A.S. 2011. *Fiscal Analysis of Shifting Inlets and Terminal Groins in North Carolina*. Program for the Study of Developed Shorelines. White Paper. Cullowhee, NC. 12pp.

Coburn, A.S. 2011 and Young, R. *Terminal Groins are Jetties*. Program for the Study of Developed Shorelines White Paper. Cullowhee, NC. 31pp.

2. Technical Outputs

- Created and maintain the nation’s only database of beach nourishment projects (web-based distribution).
- Created and currently maintain the nation’s only database of storm surge measurements (This database will eventually be managed by the National Climate Data Center). (Web-based distribution, smart phone app, and GIS database)
- Maintain an online database of coastal images including post-storm imagery. These images are distributed free of charge and are frequently utilized by major media outlets. (Web-based distribution).

3. Commercialization and Technology Transfer

NA

4. Awards and Honors

Please list and describe awards and honors conferred to faculty, staff and students as a result of their participation in the Activity. Please limit to the 20 most significant or representative publications for the period of January 1, 2008 – present.

Table E1. Awards and Honors

<i>Award or Honor</i>	<i>Date</i>	<i>Name</i>	<i>Brief Description</i>
Diversity in Action	2012	PSDS and WCU	Award for excellence in building diversity in the geosciences for the PSDS NSF-funded Elwha Science Education Project
Fulbright Senior Scholar	2012-2013	Robert S. Young	Research Award for Bulgaria

WCU Community Service Award	2011	Adam Griffith	Service award for the Rivercane Project
Geological Society of America Fellow	2011	Robert S. Young	Honorary award for lifetime contributions to the field of geosciences
University Scholar Award	2001	Robert S. Young	WCU's highest award for faculty scholarship

F. Other

Robert S. Young is a Licensed Professional Geologist in North Carolina, South Carolina, and Florida.

Meetings in Cullowhee. PSDS has hosted three, national scale meetings in Cullowhee funded by NOAA, the US Geological Survey, and the National Park Service. These meetings have brought experts and high-level government officials from across the country to WCU for a variety of different projects, all highlighting the best that WCU and western North Carolina has to offer.