

BENEFITS AND COSTS OF THE DIGITAL COAST

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION (NOAA)
COASTAL SERVICES CENTER

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Benefits and Costs of the Digital Coast

Overview

The Digital Coast is a partnership and community resource initiated by the National Oceanic and Atmospheric Administration (NOAA) Coastal Services Center for use by those organizations that manage the nation's coastal resources. The resource, in the form of a website, was developed to address the needs of its users by providing a simplified way to access data relevant to the coast, as well as the tools and methods to turn these data into useful information, increasing user efficiency and effectiveness.

This assessment of the benefits and costs of the Digital Coast is limited in scope. It reflects a full accounting of historical and expected future costs, but to reduce the cost of the analysis, only the most easily quantifiable classes of benefits were considered. Even so, the benefits that have been counted are 3.5 times greater than costs, with a return on investment of 254 percent.

From its inception in fiscal year (FY) 2007 through the end of FY2012, costs associated with the Digital Coast totaled \$5.4 million—\$4.5 million from the NOAA Coastal Services Center and nearly \$1 million¹ from Digital Coast partners. In FY2011 alone, 142,000 users downloaded data and tools from the Digital Coast, resulting in cost-reduction benefits² that equal the entire historical investment in the resource.

These investments were expected to yield a high return because they leveraged very large investments already made by others. Many millions of dollars have been spent by government agencies and nongovernmental organizations to develop the data, tools, training, and other products and services that are needed to efficiently and effectively manage the nation's coasts. The value of these resources, however, is greatly diminished by the fact that it is hard to find them, hard to determine their reliability, and hard to learn how to use them. Investments in the Digital Coast restore this lost value by identifying trustworthy products and services and making them easy to find, acquire, and use.

Background

The 2009 Assessment. This current analysis builds on an analysis of the historical and projected benefits and costs of the Digital Coast that was conducted in FY2009. Over a 15-year period of analysis, benefits were projected to exceed costs by more than 4 to 1, with a return on investment of 323 percent. The 2009 assessment considered six classes of benefits:

¹ These figures are not adjusted for inflation.

² Data downloaded from the Digital Coast save users time and money. Users spend less time looking for data because data from a number of different sources are organized on the Digital Coast in a way that makes them easy to find and acquire. Users spend less time using the data acquired through the Digital Coast because they are formatted consistently (requiring less manipulation by users) and well-documented (requiring less research by users in determining the exact nature of the data being used).

1. Reduced labor costs as users find, download, and use tools and data more rapidly
2. Reduced information technology costs to data providers as data, tools, and other content is consolidated on a smaller number of servers operated by a smaller number of IT staff members
3. Avoided development costs of duplicative tools because users found tools they needed on the Digital Coast
4. Reduced labor costs associated with users who can do their jobs more efficiently because of skills and training acquired through the Digital Coast
5. Reduced labor and other costs as Digital Coast partners share skills and leverage investments in data and tool development
6. Reduced cost of outreach for the data, tools, and training accessed through the Digital Coast when outreach by any one partner points to the products and services of all partners

All these benefits are associated with anticipated gains in efficiency (cost-reduction benefits), but the ultimate goal of many Digital Coast users is to increase the effectiveness of coastal resource management. No attempt was made, however, to quantify the Digital Coast's contribution to the value of better future conditions of coastal ecosystems because (a) it is very expensive to estimate the quantity and value of ecosystem services that are protected or enhanced by the Digital Coast, and (b) the benefits that had already been quantified were sufficient to show that planned investments in the Digital Coast made good economic sense.

Monitoring the Performance of the Digital Coast. The computations used to project benefits and costs include factors such as the projected number of downloads of data and tools, the amount of time saved by finding, downloading, and using data and tools obtained through the Digital Coast, and the cost per hour of the workers whose time is being saved. These factors were then used to monitor the actual performance of and value generated by the Digital Coast.

A comparison of projected and actual costs and usage rates indicates that (a) the cumulative costs of developing and operating the Digital Coast through FY2012 were about 22 percent higher than projected and (b) actual usage rates in FY2012 were about 100 times greater than projected.

The great disparity in projected vs. actual usage rates reflects the underlying goal of the 2009 analysis: to assess the value of the Digital Coast under conditions that were demonstrably achievable. For this reason, the analysis was built on conservative projections of use and benefits per user. It is unlikely, however, that even the most optimistic projections of usage would have equaled the actual use of the Digital Coast. It is obviously meeting a real need because a lot of people are using it and many of the same users keep coming back.

But more important than the use of conservative projections in the 2009 assessment is the growing awareness of the value of the Digital Coast among its target audience, resulting in a high demand for its products and services and very high levels of use.

A Limited Re-evaluation. The current re-evaluation of the Digital Coast is limited in scope. Although every effort was made to fully account for all project costs, only two of the original six classes of benefits were considered. One of the original two classes of benefits (that associated with the reduced labor cost

involved in finding, downloading, and using data and tools) was split in this analysis so that data and tool use could be considered separately. This yields the following three classes of benefits:

- Reduced labor costs as users find, download, and use data more rapidly
- Reduced labor costs as users find, download, and use tools more rapidly
- Avoided development costs of duplicative tools because users found tools they needed on the Digital Coast³

This analysis was limited in this way because (a) funds were not available for a more complete assessment of the benefits of the Digital Coast, and (b) the limited assessment of benefits was sufficient to show that the current investment plan for the Digital Coast is in the nation's best interest.

A 15-year period of analysis is used in this analysis, which weighs the historical and projected future benefits and costs of the Digital Coast from FY2007 to FY2021.

The Costs of the Digital Coast

By the end of FY2012, the NOAA Coastal Services Center will have invested \$4.5 million⁴ in the Digital Coast.⁵ Most of these costs (88 percent) were labor costs associated with building the Digital Coast infrastructure; developing, acquiring, integrating, and maintaining the inventory of products and services delivered by the Digital Coast; and working with partners to ensure that the Digital Coast delivers useful products and services of the highest degree of quality and relevance.

Over the project's life, the partners themselves have invested another \$900,000⁶ in the Digital Coast. This represents the labor, travel, and other costs incurred by partners as they work alongside the NOAA Coastal Services Center in developing, reviewing, and refining Digital Coast content. In FY2012, costs incurred by partners accounted for 28 percent of total project costs.⁷

³ Benefit class numbers 1 and 3, from the 2009 analysis.

⁴ This figure is not adjusted for inflation. Before these costs were used in the assessment of return on investment, they were adjusted to reflect January 2012 price levels.

⁵ Labor and other costs incurred by the NOAA Coastal Services Center are based on actual expenses as represented in the Center's management and budget records.

⁶ This figure is not adjusted for inflation. Before these costs were used in the assessment of return on investment, they were adjusted to reflect January 2012 price levels.

⁷ This analysis is conducted from the perspective of the federal government, accounting for all costs to the nation. The labor, travel, and other costs incurred by Digital Coast partners are thus added to the expenditures of the NOAA Coastal Services Center to represent the full cost to the nation.

Annual costs increased from \$375,000 in FY2007 to just over \$1 million in FY2010,⁸ as the Digital Coast developed from an idea to a reality. Since then, annual costs have increased more modestly and are projected to continue to do so until FY2014, after which they are projected to remain constant at just over \$1.4 million annually.

The costs described in this section are based largely on accounting records and are presented in figures that have not been adjusted for inflation. Before incorporating these values into an assessment of the return on investment, it is necessary to account for the effects of inflation. Table 1 shows the annual cost by major category. Table 2 shows the same information, adjusted to remove the effects of inflation.

⁸ Figures not adjusted for inflation.

Table 1: Current Dollar Costs

Fiscal Year (FY)	CSC Non-Labor	CSC Federal Labor	CSC Contract Labor	Partner Costs	Total	Cumulative Total
FY07	\$181,142	\$58,110	\$109,326	\$26,000	\$374,578	\$374,578
FY08	\$77,028	\$157,668	\$435,162	\$26,000	\$695,858	\$1,070,437
FY09	\$70,205	\$239,037	\$452,768	\$52,000	\$814,010	\$1,884,447
FY10	\$77,028	\$280,115	\$498,398	\$227,000	\$1,082,542	\$2,966,988
FY11	\$86,814	\$321,194	\$544,029	\$227,000	\$1,179,036	\$4,146,024
FY12	\$22,220	\$584,042	\$317,260	\$360,775	\$1,284,297	\$5,430,322

CSC = Coastal Services Center

Table 2: Constant Dollar (January 2012) Costs

Fiscal Year (FY)	CSC Non-Labor	CSC Federal Labor	CSC Contract Labor	Partner Costs	Total	Cumulative Total
FY07	\$196,989	\$63,194	\$118,890	\$28,275	\$407,348	\$407,348
FY08	\$82,045	\$167,938	\$463,507	\$27,694	\$741,184	\$1,148,531
FY09	\$73,448	\$250,079	\$473,683	\$54,402	\$851,612	\$2,000,143
FY10	\$80,091	\$291,255	\$518,218	\$236,027	\$1,125,592	\$3,125,735
FY11	\$88,534	\$327,559	\$554,810	\$231,499	\$1,202,402	\$4,328,137
FY12	\$22,220	\$584,042	\$317,260	\$360,775	\$1,284,297	\$5,612,434

CSC = Coastal Services Center

The Benefits of the Digital Coast

The Digital Coast is designed to improve the efficiency and effectiveness of coastal resource managers. This means that the people whose analyses and decisions will shape the future state of our coasts can do their jobs at a lower cost because of the data, tools, training, case studies, and other products and services provided through the Digital Coast. But these efficiency gains are only part of the story. The other more important aspect is that these same people will be able to do their jobs better—making better decisions leading to better economic and environmental outcomes.

Measuring efficiency gains is pretty straightforward. If a person who makes \$36 per hour⁹ needs data to do her job and the data she obtains from the Digital Coast are in a format that makes them easier to use, saving her one hour of labor—that's a \$36 benefit. If that sort of thing happens tens of thousands of times each year, the numbers add up.

⁹ For illustration only. However, \$36 per hour is the rate that was used for GIS technicians in the benefit estimates.

Measuring gains in effectiveness—how the Digital Coast contributes to a brighter economic and ecological future—is complicated. The relationship between planning, development, and governance on the one hand, and the economy and the environment on the other, is complex, uncertain, and often poorly understood.

The three classes of benefits considered in this analysis are projected to greatly outweigh the total costs of the project.

All the benefits considered in this analysis represent cost reductions to users of the Digital Coast. All benefits were estimated at January 2012 price levels. Estimates of the value of reduced labor costs as users find, download, and use tools and data more rapidly account for 96 percent of the total benefits considered in this analysis. These benefits, shown in Table 3 under the headings of “Data Use” and “Tool Use,” are a function of

- The number of data downloads [Actual Web statistics were used through the end of FY2011; the FY2011 figure was projected to grow by 2 percent annually thereafter.]
- The average time savings (hours) realized by users of the data and tools [These savings are the result of (a) users being able to find data and tools more rapidly because products from many government and nongovernmental sources can be found in one well-organized website, (b) data that are easier to use because they have been pre-processed and are delivered in standard, well-documented formats, and (c) users being able to do their jobs more efficiently because they used a tool that they discovered and downloaded from the Digital Coast. The average savings per user is based on discussions with Digital Coast partners who use the website.]
- The average hourly cost of data users [This reflects a mid-range value for GIS technicians based on a review of data from the Bureau of Labor Statistics, government contracts, and other sources.]

Estimates of the value of avoiding the costs of developing duplicative tools because users found tools they needed on the Digital Coast account for the remaining 4 percent of the benefits considered in this analysis. These benefits, shown in Table 3 under the heading of “Tool Development,” are a function of

- The number of duplicative tools not created [estimated at one per year]
- The cost of tool development [estimated at \$250,000 per tool based on discussions with Digital Coast partners, reflecting the costs incurred by government and nongovernmental organizations]

Table 3: Constant Dollar (January 2012) Benefits Associated with Three Key Benefit Classes

Fiscal Year (FY)	Data Use		Tool Use		Tool Development		Total
	Users	Benefits (\$ Million)	Users	Benefits (\$ Million)	Tool Savings	Benefits (\$ Million)	Benefits (\$ Million)
FY07	-	-	-	-	-	-	-
FY08	-	-	-	-	-	-	-
FY09	-	-	-	-	-	-	-
FY10	19,165	\$0.69	8,271	\$0.30	1	\$0.25	\$1.24
FY11	26,770	\$0.96	115,000	\$4.14	1	\$0.25	\$5.35
FY12	27,305	\$0.98	117,300	\$4.22	1	\$0.25	\$5.46
FY13	27,852	\$1.00	119,646	\$4.31	1	\$0.25	\$5.56
FY14	28,409	\$1.02	122,039	\$4.39	1	\$0.25	\$5.67
FY15	28,977	\$1.04	124,480	\$4.48	1	\$0.25	\$5.77
FY16	29,556	\$1.06	126,969	\$4.57	1	\$0.25	\$5.88
FY17	30,147	\$1.09	129,509	\$4.66	1	\$0.25	\$6.00
FY18	30,750	\$1.11	132,099	\$4.76	1	\$0.25	\$6.11
FY19	31,365	\$1.13	134,741	\$4.85	1	\$0.25	\$6.23
FY20	31,993	\$1.15	137,436	\$4.95	1	\$0.25	\$6.35
FY21	32,632	\$1.17	140,184	\$5.05	1	\$0.25	\$6.47

A Comparison of Benefits and Costs

When considering benefits and costs that are incurred over a number of years, the dollar values must be adjusted to reflect the fact that a dollar received today is considered more valuable than a dollar received in the future. One important reason for this is the fact that a dollar received today could be invested to produce additional wealth.

The White House Office of Management and Budget (OMB) prescribes specific “discount rates” to be used in making this adjustment.¹⁰ According to OMB guidance, the discount rate used for this analysis (1.4 percent) reflects the linear interpolation between the real interest rates for 10-year and 20-year treasury notes and bonds.

¹⁰ See www.whitehouse.gov/sites/default/files/omb/assets/a94/dischist-2012.pdf.

Benefits and costs have already been adjusted to ensure that they are being measured in the same units of value (in this case, January 2012 dollars). This second adjustment, called discounting, is used to show the “present value” of benefits and costs that occur over time. The effect of this is to give more weight to values closer to the present and less weight to values in the remote future. The base year for determining present values is 2007.

The present values of benefits and costs are shown in Tables 4 and 5 below.

**Table 4: Present Values of Constant Dollar Costs
(Millions of January 2012 Dollars)**

Fiscal Year (FY)	Cost	Present Value Cost
FY07	\$0.4	\$0.4
FY08	\$0.7	\$0.7
FY09	\$0.9	\$0.8
FY10	\$1.1	\$1.1
FY11	\$1.2	\$1.1
FY12	\$1.3	\$1.2
FY13	\$1.4	\$1.3
FY14	\$1.4	\$1.3
FY15	\$1.4	\$1.3
FY16	\$1.4	\$1.3
FY17	\$1.4	\$1.2
FY18	\$1.4	\$1.2
FY19	\$1.4	\$1.2
FY20	\$1.4	\$1.2
FY21	\$1.4	\$1.2
Total	\$18.4	\$16.5

**Table 5: Present Values of Constant Dollar Benefits
(Millions of January 2012 Dollars)**

Fiscal Year (FY)	Benefit	Present Value Benefit
FY07	\$0.0	\$0.0
FY08	\$0.0	\$0.0
FY09	\$0.0	\$0.0
FY10	\$1.2	\$1.2
FY11	\$5.4	\$5.1
FY12	\$5.5	\$5.1
FY13	\$5.6	\$5.1
FY14	\$5.7	\$5.1
FY15	\$5.8	\$5.2
FY16	\$5.9	\$5.2
FY17	\$6.0	\$5.2
FY18	\$6.1	\$5.2
FY19	\$6.2	\$5.3
FY20	\$6.3	\$5.3
FY21	\$6.5	\$5.3
Total	\$66.1	\$58.3

A number of measures exist for comparing the present value of benefits and costs. Three are presented below: net present value, benefit-cost ratio, and return on investment. The formulas used to compute these three measures show that they are slightly different ways of saying the same thing about the relative magnitude of benefits and costs. To help illustrate the similarity, the terms “benefits” and “costs” are used to indicate the present value of benefits and costs in the formulas below.

$$\text{Net Present Value} = \text{Benefits} - \text{Costs}$$

$$\text{Benefit-Cost Ratio} = \text{Benefits} / \text{Costs}$$

$$\text{Return on Investment} = (\text{Benefits} - \text{Costs}) / \text{Costs}$$

Inserting the values for the present values of benefits and costs from Tables 4 and 5, we have:

$$\text{Net Present Value} = \$58.3 \text{ million} - \$16.5 \text{ million} = \$41.8 \text{ million}$$

$$\text{Benefit-Cost Ratio} = \$58.3 \text{ million} / \$16.5 \text{ million} = 3.5$$

$$\text{Return on Investment} = (\$58.3 \text{ million} - \$16.5 \text{ million}) / \$16.5 \text{ million} = 254 \text{ percent}$$

Sensitivity Analysis

Finally, this analysis tested the sensitivity of the results to changes in the variables used to estimate benefits and future costs. The results of these tests are shown in Table 6. Although the assumptions reflected in the analysis presented above were reviewed by the Digital Coast partners and other economists within NOAA, it is still important to identify factors with a disproportionate influence on the value of the Digital Coast.

Given the high rate of usage of the Digital Coast, further increases or, conversely, a flattening of usage rates does not have a big effect on the return on investment (ROI). Similarly, error in the wages paid to workers whose time is being saved and modest increases in costs do not have a pronounced effect on ROI.

Not surprisingly, ROI is most sensitive to the amount of time saved by users of the data and tools. Future refinements of the ROI assessment should focus first on using surveys or similar tools to refine the estimates of this variable.

Finally, recall that this analysis compares three classes of benefits with the full cost of the Digital Coast. Small or negative values in Table 6 reflect this fact. A more complete assessment of the cost-reduction benefits and the benefits of improved effectiveness (which were not addressed at all in this analysis) would increase the ROI significantly.

Table 6: Sensitivity Tests

Test Case	Future Cost	Hourly Labor Cost (\$/Hour)	Labor Savings per Data Download (Hours)	Labor Savings per Tool Download (Hours)	Annual Growth Rate, Downloads	ROI
Base Case	Flat After 2014	\$ 36.00	1.00	1.00	2%	254%
Time Savings	Flat After 2014	\$ 36.00	0.50	0.50	2%	85%
Time Savings	Flat After 2014	\$ 36.00	0.25	0.25	2%	1%
Time Savings	Flat After 2014	\$ 36.00	2.00	2.00	2%	591%
Usage Growth	Flat After 2014	\$ 36.00	1.00	1.00	0%	223%
Usage Growth	Flat After 2014	\$ 36.00	1.00	1.00	4%	289%
Labor Cost	Flat After 2014	\$ 41.00	1.00	1.00	2%	301%
Labor Cost	Flat After 2014	\$ 31.00	1.00	1.00	2%	207%
Real Cost Increases	2% annually after 2014	\$ 36.00	1.00	1.00	2%	239%
Real Cost Increases	10% annually after 2014	\$ 36.00	1.00	1.00	2%	183%
Combination	10% annually after 2014	\$ 36.00	1.00	1.00	0%	158%
Combination	10% annually after 2014	\$ 36.00	0.25	0.25	0%	-26%

Changes from base case are shown in **bold**.

Next Steps

As noted above, this assessment of the benefits and costs of the Digital Coast is limited in scope, accounting as fully as possible for historical and expected future costs of only the three most easily quantifiable classes of benefits. A more comprehensive assessment of the benefits of the Digital Coast should also consider the following:

- The Digital Coast makes it easier to use more advanced, more sophisticated, or different tools.
- Users acquire new skills or approaches through training or use of tools and information delivered via the Digital Coast.
- The Digital Coast partnership allows participants to share skills and leverage investments in data and tool development, bringing down their cost of doing business.
- When Digital Coast partners share the task of outreach for data, tools, and training provided by the Digital Coast, the outreach cost of each participant is likely to decline.
- Some resources provided by the Digital Coast are housed at a single location, increasing the efficiency of hardware, software, and human resources needed to maintain these resources.
- The Digital Coast improves the effectiveness of those managing the resources of the coasts, oceans, and Great Lakes (resulting in better future conditions of coastal ecosystems)

In addition, estimates for the three classes of benefits considered in the current analysis could be refined by conducting surveys to learn more about the cost-savings associated with the use of the Digital Coast—for example, how much time did users actually save because of the improved access and consistent formatting and documentation of the data and tools acquired through the Digital Coast? What are the fully loaded costs of the persons whose time was saved? While this limited study was sufficient to show that the current investment plan for the Digital Coast is in the nation's best interest, it is clear that broader and deeper analyses of all benefit classes will yield further benefits of the Digital Coast.