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White Paper

Natural and Cultural Resource Valuation:

A Place-Based, Resource-Driven Approach

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Abstract

This paper develops a place-based resource-driven approach to assessing the values associated with natural and cultural resources. Existing methodologies examine the value of natural and cultural resources, but are often criticized for being uni-dimensional. These methods generally produce quantitative monetary values for market and non-market resources. The natural and cultural resources associated with a national park are analyzed in terms of the expressed values of active stakeholders to quantitatively produce multiple dimensions of value for each resource relative to all others. The resulting value-space creates a context for environmental decision-making that proactively contributes throughout the decision process.

Keywords: resource valuation, intrinsic values, place-based valuation, natural and cultural resources, value-space

1. Introduction

This paper develops a place-based resource-driven methodology for assessing the values of natural and cultural resources. A number of preference-based measures exist for valuing natural and cultural resources. Ciriacy-Wantrup (1947) conceptualized the maximum monetary value a person is willing to pay (exchange, sacrifice or otherwise barter) for a public good as one measure of value for non-market resources. These measures rely on preferences (usually expressed in response to a survey) for a hypothetical outcome(s). Davis (1963) designed and implemented the first survey using willingness to pay, correlating the results with the travel cost method, and found results that were quite similar. In spite of these early tests of reasonableness, reservations were raised about using partial values to represent resources, which encourages (or subsidizes) over-use of scarce resources (Krutilla, 1967). Contingent valuation measures stemming from the willingness-to-pay concept have become widely used in valuing environmental resources and outcome(s). In spite of widespread use in the 1980's, a debate ensued between those who found these measures sufficiently valid to warrant requiring their use in environmental regulation and those who opposed such requirements because of the under-representation of non-market values (Portney, 1994). This paper accepts the idea that uni-dimensional measures of natural and cultural resources under-represent the value associated with these resources. It develops a methodology that assesses the intrinsic values of natural and cultural resources associated with a particular place in multiple dimensions. The result is an abstract value-space that represents the unique contribution(s) of significant dimensions of value relative to and independent of one another.

Meaningfully including the value of natural and cultural resources in resource management decisions is one of the most vexing problems facing resource managers, planners and policy makers. As individuals and members of a community humans hold unique and complex relationships with the surrounding natural and cultural resources. Surrounding landscapes are complex, and when viewed holistically have unique identities that blend the natural and cultural resources found therein (Antrop, 2005). Each interaction, whether as a participant in a landscape or as a policy maker affecting that landscape, reflects the individual's values associated with that place and its resources. While these resources are both highly valued and valued for a variety of reasons, measuring that value is limited by the ways in which the values can be associated with the resources, few of which can incorporate multiple dimensions. As a result, these measures often fail to contribute significant portions of the individual or shared community value associated with these resources in the information guiding decision processes that affect them (Bingham et al., 1995; Loomis, 2000; NRC, 2005). This under-representation of value is most often the case when non-market resources, those not easily quantified or included in economic efficiency analyses, are considered (Loomis, 2000). This paper quantitatively assesses the intrinsic values associated with natural and cultural resources in a national park. Resources are placed in juxtapostion to one another in an abstract value-space of multiple dimensions. Each dimension is unique from all others and significantly contributes to the overall value-space.

Friedmann (1987 p. 36) conceptualized planning as using scientific knowledge to inform action in the public domain, which involves making scientific and technical knowledge effective in informing plans, policy and public actions. Three specific activities of planning include "…making forecasts, obtaining appropriate forms of citizen participation, and constructing models useful in exploring alternative action-strategies.” Ackoff (1974 p.5) describes preactive planning as problem solving “…based more on logic, science and experimentation than common sense”; it often involves specifying goals and objectives, selecting appropriate planning tools (e.g., courses of action, programs, or policies), and determining the resources required. Interactive planning usually adds understanding organizational requirements, and designing the implementation; it is (a) participatory in that it is done by the system not for it, (b) coordinated across functional boundaries, (c) integrated at all levels, and (d) continuously updated, corrected and revised to assure it adapts to its environment. Effective plans also reflect the community’s values in plans, policies and decisions, while respecting (assigning importance to) stakeholder-values (Brody et al., 2003). To be comprehensive then, resource managers must fully account for all the natural and cultural resources in the community (i.e. how could comprehensive claims have meaning without complete representation?); each resource will have to have all significant dimensions represented (i.e., how could it be comprehensive if significant intrinsic values are omitted?); and all stakeholders need to be involved in the resource assessment (i.e., how could it be comprehensive while only representing limited perspectives?). In this light, it becomes apparent that better understanding of ways to assess and include values for non-market resources in planning decision processes is essential (Bingham et al., 1995; de Groot, 2006). This paper assesses the intrinsic values of natural and cultural resources in a national park. The values of the most important resources are expressed by active stakeholders. These expressed values are analyzed to reveal the underlying dimensions of value that are most significant to the the value-space.

2. Literature

George Perkins Marsh in 1864 recognized that decisions regarding nature involved intrinsic values that, while difficult to include in the process, are no less significant (Marsh and Lowenthal, 2003). Decisions that deal with impacts to natural and cultural resources inherently involve complex problems that demand appropriately complex sets of information to be considered (Bingham et al., 1995; de Groot, 2006; Seip and Wenstop, 2006). Thus it serves to reason that decision makers with greater access to information and perspectives that can address the complexities of the problem at hand will have a greater opportunity to make better-informed choices (Hall and Davis, 2007).

There are several dominant methods by which values for natural and cultural resources can be established, all of which have previously been discussed at length in the literature. Revealed preference measures such as market prices, hedonic pricing and travel costs are used to observe actual consumer behaviors and from that to impute monetary values for certain resources or their services (Heal, 2000; Loomis, 2000). While these do provide accurate measures, they have, however, been criticized for their inability to capture multiple types of value such as difficulties in attributing value to trips with multiple destinations or for the way multiple bundled resources are represented by a single value (Bingham et al., 1995; Clough and Meister, 1991; Loomis, 2000). Stated preference measures, such as contingent valuation (CV) or the related contingent choice, use individual responses to hypothetical scenarios, to better understand our preferences for future changes to our landscapes (Arrow et al., 1993; Daly and Farley, 2004). Again, these do provide meaningful measures of value. However, criticisms include arguments that the nature of CV (a) violates the principles of rational choice (Arrow et al., 1993), (b) can include embedding effects and inflated hypothetical values (Diamond and Hausman, 1994), (c) is unable to allow respondents to work proactively, (d) requires respondents to value pre-selected alternatives with bundled resources in an all-or-nothing choice situation (Hanley et al., 1998), and (e) the idea that a single monetary value cannot take into account socially or culturally constructed values for most resources (Stephenson, 2008).

Finally, there are methods that can be used to incorporate multiple sets of information into one measure in order to address some of the complexities of dealing with natural and cultural resources. Techniques such as Multi-Criteria Analysis and the Analytic Hierarchy Process offer plausible methods to incorporate market and non-market use values. While they do carry some of the same criticisms of being based on hypothetical scenarios and prescribed alternatives (Duke and Aull-Hyde, 2002; Munda et al., 1994), nonetheless, they can be seen as moving in a direction that recognizes resources as worth much more than just the sum of independent monetary values and toward using a "plurality" of measures to form a more holistic representation of resource value (Arrow et al., 1993; Farber et al., 2002).

Resource managers in the institutional realm are often challenged with complex decisions that are most often approached using some form of the Cost-Benefit Analysis (CBA). Whether through local decision processes employing CBA as an efficient way to assess multiple criteria, or through National Environmental Policy Act (NEPA) processes that require the use of CBA, assembling multiple value types into one analysis directs most of these resource decisions. At its core, CBA presents a systematic way to assess alternative courses of action. An outcome is seen as positive if the measurable benefits of an action are expected to exceed the measurable costs that will be incurred. Further, when assessing a range of alternatives, the alternative that produces the maximum ratio of benefit to cost is the most desired action (Arrow et al., 1996; Kelman, 1981). This process is typically linear and follows the basic steps of 1) articulation of the problem, 2) objectives to be considered, 2) forming multiple decision alternatives and attendant impacts, 4) valuation, assessment and ranking of alternatives, 5) selection of a preferred alternative, and 6) implementation (Noble, 2006; Seip and Wenstop, 2006). Figure 1 graphically illustrates this process in a simplified manner. This linear process is reactionary in nature, relying on pre-formed problems, objectives and alternatives before value assessments are made. Participation is recognized as an import element of the decsion process (e.g., Noble, 2006; Seip and Wenstop, 2006). Active and early participation offers the potential to obtain and include value information in the critical problem and objectives formation stages of the decision process. In fact, it can inform the entire decision process including selection of preferred alternative and implementation.

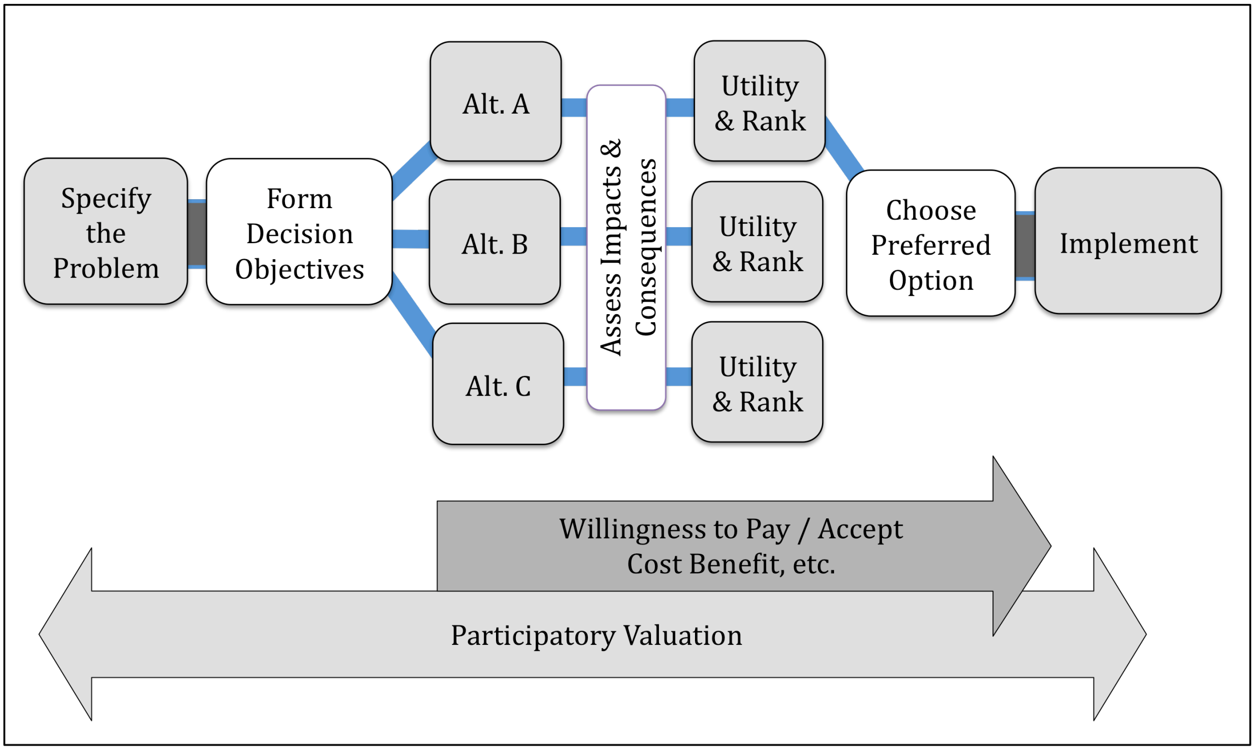

Figure 1. Graphic representation of a typical linear process of environmental decision making (Noble, 2006; Partidário and Clark, 2000; Seip and Wenstop, 2006).

These decision processes assumes that the optimal decision will provide the maximum satisfaction of preference for the entire community. This seems to be a rational way to approach the problem, however, as O'Neill and Spash (2000) point out, these approaches measure a combined strength of preference intensity without addressing the strength or weakness of potentially multiple underlying reasons for those preferences. In these cases, easily constructed values (e.g. timber harvests, increased tourism visits) have an advantage over more problematic types of value (e.g., social, cultural, psychological, ethical considerations and preferences resulting in "optimal" decisions that do not reflect the complex preferences of the community). While many authors have argued that this is far from being the recommended approach (Arrow et al., 1996; Easter et al., 1999; Hanley, 1992; O'Neill and Spash, 2000) this is not to say that

CBA has no place in the valuation process. Rather it is one input that can make important contributions to a broader set of information to be considered by decision makers.

Two problems become apparent. First, problems cannot be seen as static, wholly formed or "given" at the beginning of a decision process. Ackoff (1974) makes the point that problems are actually abstractions and can be shifted, re-focused and even re-framed, depending upon the dynamic information and sets of individuals that are utilized to conceive the problem. Thus, if problems are not static, but can be significantly affected by the sets of information that surround the problem, wouldn't it be beneficial to have more comprehensive sets of information prior to problem and alternative formation, especially information that addresses multiple dimensions of value? Second, typical linear decision processes as shown in Figure 1 above become reactive to alternatives that may or may not reflect the full range of values that community members hold for resources that may be impacted. To utilize resource values in a proactive way, these values, from multiple perspectives and embracing multiple dimensions of value, should be incorporated throughout the entire process from problem formation through implementation.

Hence, CV-based measures for assessing values of environmental resources are widely used as the best available quantifiable methodology, but simultaneously condemned as not characterizing the complete picture. While putting a single monetary value on environmental resources represents a recognition that they have value and should not be treated as a free gift of nature, willingness-to-pay measures are often criticized as failing to represent the full spectrum of value associated with the resource(s) under consideration. This becomes essentially a subsidy to those who benefit from the value measured but do not take on the costs of other unmeasured value dimensions.

While unique, this situation is vaguely similar to circumstances surrounding the quantification of risk. A committee chaired by Norman Rasmussen (1975) was commissioned by the Nuclear Regulatory Commission to examine the risk of a nuclear power plant accident. While the resulting risk measures were broadly acknowledged as the best available, the estimates were also recognized as subject to large amounts of uncertainty and subsequent criticism. For example, the Rasmussen Report only considered a death as related to nuclear power if it occurred within 24-hours of the exposure, yet cesium released from a reactor could remain active in the environment for years, and one of the most serious illnesses stemming from reactor accidents is cancer which often takes years to even be detected. It also assumed the independence of probabilities from various sources, which Perrow (1984) showed were not truly independent in large tightly coupled technological organizations. Chauncey Starr (1969) used a revealed preference approach to quantify acceptable levels of technological risk in the context of the associated social benefits. Risk was then, and even with these criticisms is now, quantified as the likelihood and consequences of the occurrence of undesirable events (e.g., Rowe, 1977; Suter and Barnthouse, 1993). Slovic, Fischhoff and Lichtenstein (1986) recognized that there were more dimensions to perceived risk than simply the product of probability and consequence. They assessed 30 risks along eighteen characteristics of risk, which resulted in the two underlying abstract dimensions of dread and unknown. This paper employs a similar technique to analyzing environmental resources associated with a national park.

3. Setting

Data collected during the creation of this new methodology were a part of a storm recovery planning process undertaken for Cape Lookout National Seashore in North Carolina. Cape Lookout is a 90 km long barrier island system within the National Park Service (see Figure 2).

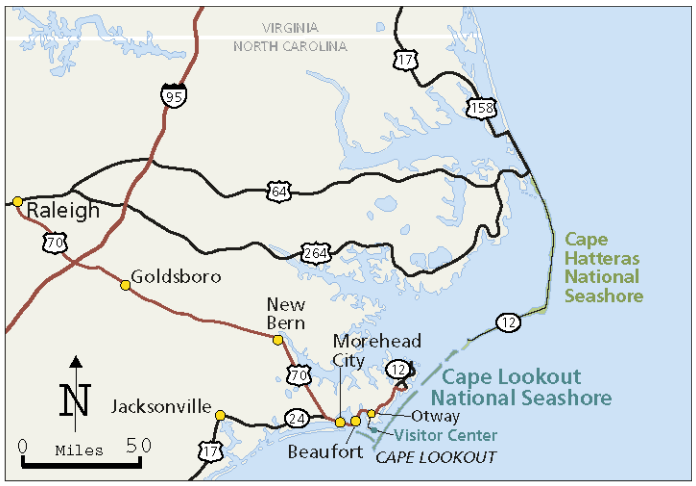

Figure 2. Location Map of Cape Lookout National Seashore (National Park Service, 2010).

Damaging storms, most often tropical storms and hurricanes, are a consistent threat to Cape Lookout and their impacts have greatly affected park resources and operations over the decades (National Park Service, 2004). While some planning is in place to prepare for damaging storms, this process contributes to the rationale for the priority given to individual natural and cultural resources (most of them non-market). These priorities will eventually inform funding decisions concerning the preservation and protection of these resources. Further, external hazard response teams are often are used in recovery efforts. As a result of their unfamiliarity and the possibility of local staff being unavailable, recovery decisions are at risk of being made without the benefit of key pieces of knowledge and guidance on how to take into account the values of unique natural, cultural and historic resources. The storm recovery planning effort was intended to address some of these concerns in light of resource valuation.

The range of resources at Cape Lookout is broad, but can be categorized into three basic categories. First, significant natural resources include a diverse mix of plant and animal species present in with its dune and beach and ocean fisheries systems and include four listed endangered species within the park. The park is also home to a legislatively-protected herd of wild horses, the Shackleford Banks Horses. Second, cultural and historic resources tie most directly to its history among the seafaring communities of coastal North Carolina, and include two historic maritime villages of Portsmouth and Cape Lookout and include the iconic Cape Lookout Lighthouse, two lighthouse keeper's quarters, two life saving stations, a former Coast Guard station and numerous homes. Finally, infrastructure resources include individual elements and systems such as dockage, sand and paved roads, restrooms, visitor centers, water and septic systems, communication facilities and maintained waterways. These infrastructural resources are important as supporting elements to the cultural resources within the park and to the overall park operations.

4. Methods

This approach is place-based in that resources considered are geographically and culturally associated with the place; it is resource driven in that the value(s) associated with each resource provides the primary stimulus central to the assessment. The place-based resource-driven approach to valuation involves the identification of resources critical to the place, and assessing the value(s) associated with each significant resource. A parsimonious model of the value structure that accounts for significant variation in the pattern of responses is used to create value-space that presents each resource relative to all others. These resource-driven value structures are critically important in problem formation and the determination of appropriate alternative solutions, and can contribute to alternative selection and implementation. Hence they can provide a proactive environmental tool in shaping environmental decision processes.

4.1. Stakeholder Survey

A survey identified 49 important park resources based on resource inventories and allowed the respondent to add other resources by choosing the ten resources "most important to the park." A brief web-based survey, taking 15.2 minutes on average to complete, rated each of the selected resources. The ratings for "fundamental character," "attracting visitors," "scenic beauty," and "ability to operate," solicited expressed importance on a zero-to-ten Thurstone scale, where zero indicated "not at all important," and ten represented "extremely important." The "ability to be replaced" also used a Thurstone scale, but zero indicated "not able to be replaced" and ten represented "easily replaced."

These five types of value were developed through discussions with park staff concerning resources and their view of the reasons various resources were important to the park. A stakeholder-based valuation methodology, informed partly by the work of Slovic et al (1981) was developed to measure the values for specific park resources along multiple dimensions. While 178 of 219 people that opened the web survey selected the ten-most important resources (or 83.1%), 153 respondents rated the selected resources. It is not possible to know how many people were asked (e.g., via stakeholder meetings, email lists, email forwarding, and general solicitation) to participate in the survey, but never opened the web survey. In keeping with ethical standards of survey conduct regarding consent and free will, respondents were allowed to skip questions at their discretion. Some respondents indentified unique resources not represented in the inventory. Of the 49 initially listed resources, only 47 were included in two or more respondent's top-ten-selections. Increasing the minimum threshold to four or more top-ten selections resulted in very minor alterations in the resource means and subsequent factor analysis component loadings, but reduced the number of resources considered to 44 rather than 47. Thus using a threshold of two is consistent with the focus herein on shared-value, while maximizing the number of resources considered and controlling the potential for measurement volatility. The mean rating, standard deviation, number of ratings and relative ranking of each resource is presented in Table 1.

	Important to Character				Important to Scenic Beauty				Important to Visitation				Important to Operations				Able to be Replaced			
Resource Name	N	Mean	SD	Rank	N	Mean	SD	Rank	N	Mean	SD	Rank	N	Mean	SD	RANK	N	Mean	SD	Rank
CL Lighthouse	131	9.70	1.08	1	136	9.75	1.03	1	136	9.65	1.21	1	132	7.75	3.58	1	135	0.89	2.00	9
Shackleford Banks Horses	68	9.34	1.20	2	69	9.38	1.13	2	69	9.48	0.93	2	67	5.96	3.71	4	68	1.18	2.49	16
CL 1873 Keeper's Quarters	71	8.82	1.81	3	71	8.75	1.95	3	72	8.42	1.97	3	71	6.68	3.28	3	73	1.16	1.99	15
Dune & Beach Systems	62	9.40	1.52	4	63	9.44	1.58	5	64	9.25	1.68	4	63	8.05	3.16	2	63	1.37	2.47	14
PV Methodist Church	67	8.63	2.01	5	68	8.85	1.75	4	68	8.50	2.26	5	68	5.49	3.69	6	68	1.10	2.61	17
PV Life Saving Station	58	8.84	1.91	6	56	8.66	1.91	6	57	7.79	2.70	6	57	5.21	3.70	10	57	1.07	2.20	22
CL Life Saving Station	54	8.89	1.72	7	55	8.80	1.65	7	55	7.98	2.22	7	51	5.61	3.55	11	53	1.42	2.52	18
Salt Marsh	50	9.32	1.42	8	50	9.66	0.82	8	51	8.47	2.01	8	51	7.49	3.57	5	51	1.20	2.32	23
Ocean & Sound Fisheries	47	9.32	1.67	9	47	8.53	2.73	9	47	9.04	1.85	9	47	7.70	3.30	7	48	1.81	2.77	13
Historic Cemeteries (6)	47	8.70	2.02	10	44	7.93	2.50	14	45	7.98	2.79	13	45	5.49	3.51	16	45	0.27	1.50	43
CL Coast Guard Station	45	8.93	1.60	11	44	8.48	1.89	10	46	7.96	2.09	10	43	6.35	3.43	13	46	1.50	2.14	19
PV Historic Houses (16)	45	8.73	1.84	12	44	8.30	2.31	12	44	8.27	2.09	11	44	5.75	3.40	15	44	1.25	2.50	25
PV P.O & General Store	46	8.24	2.16	13	46	8.04	2.31	11	46	7.35	2.95	15	45	5.20	3.47	19	46	1.09	2.56	27
Restrooms	52	6.85	3.21	14	50	4.32	3.48	22	50	7.24	2.97	12	47	7.47	2.77	8	51	8.04	2.73	1
PV Schoolhouse	40	8.75	1.94	15	41	8.22	2.33	15	41	8.17	2.47	16	40	5.98	3.41	18	41	1.15	2.64	28
Maritime Forests	38	9.00	2.19	16	38	9.26	1.93	13	38	8.32	1.89	18	38	6.76	3.48	14	37	0.76	1.64	38
GI Fish Camp Cottages (21)	38	8.55	2.44	17	38	6.84	3.08	20	38	9.13	2.04	14	37	7.51	3.01	12	37	6.16	3.36	2
Lighthouse Visitor Center	40	7.55	2.64	18	40	6.75	2.92	19	40	7.93	2.49	17	38	7.87	2.13	9	39	5.46	3.29	3
CL 1907 Keeper's Quarters	34	8.85	1.70	19	33	8.52	1.95	18	33	8.06	2.30	21	32	5.78	3.37	23	32	0.97	1.89	36
Tidal Flats	34	8.82	2.62	20	33	9.27	1.96	16	33	8.48	2.14	20	33	7.36	3.68	17	33	1.21	2.56	30
Endangered Sea Turtles	36	8.31	1.77	21	36	7.81	2.83	17	38	7.45	2.39	19	38	4.32	3.66	24	38	1.74	3.12	21
CL Area Historic Houses	29	8.59	1.79	22	30	8.53	2.05	21	30	7.70	2.67	22	27	5.15	3.45	26	30	1.07	2.16	34
Roads	30	7.73	2.41	23	29	5.93	3.21	24	30	7.33	2.88	24	29	7.69	3.11	20	30	7.03	3.02	4
LP Cabins (20)	26	8.15	2.56	24	26	6.08	2.84	25	26	8.88	1.99	23	26	7.81	2.81	21	25	6.80	3.32	5
Aesthetic Env. experiences	20	9.70	0.80	25	20	10.00	0.00	23	20	9.95	0.22	25	20	6.90	4.09	27	19	1.53	2.87	37
Dockage Areas (6)	22	8.59	1.94	26	22	6.68	2.92	27	22	8.36	2.28	26	21	9.33	1.46	22	22	7.09	3.39	7
Water Systems (3)	21	7.81	2.27	27	21	5.57	3.76	30	21	7.67	2.73	27	20	7.50	3.05	25	21	7.52	3.04	6
Truck & Off Road Vehicle	17	9.29	1.00	28	16	7.00	3.25	31	16	8.38	2.28	29	16	8.38	2.13	28	16	6.69	3.14	10
Migratory Birds & Habitats	18	8.56	2.38	29	18	8.67	2.22	26	19	8.32	2.38	28	18	5.56	3.79	31	18	1.00	1.68	40
South Core Banks Jetty	15	9.27	1.44	30	15	8.33	2.47	28	15	7.80	2.34	31	15	5.93	3.43	33	15	2.67	3.22	31
Other Nesting Shorebirds	15	9.00	1.14	31	13	9.15	1.14	29	13	7.92	2.18	34	12	5.33	3.37	35	13	0.92	1.38	44
Shelters & Pavilions	18	6.78	2.44	32	16	5.44	2.53	34	18	7.39	2.43	30	18	6.50	2.46	29	18	7.28	2.70	8
Parking Lots	15	8.00	2.42	33	15	5.33	3.83	35	15	7.13	2.56	33	15	7.53	3.04	30	15	7.13	3.44	11
Pedestrian Trails &	13	7.85	2.44	34	14	6.86	2.38	32	13	8.38	1.85	32	14	6.57	3.30	32	14	7.07	2.09	12
Beafort's Bottlenosed	10	8.20	2.58	35	11	8.09	2.59	33	10	7.70	2.63	35	10	3.30	3.62	42	11	1.09	1.92	45
Les & Sally's Env. Camp	8	8.50	2.14	36	8	5.25	3.77	38	8	6.75	3.15	37	8	6.38	3.42	37	8	3.38	3.54	39
Pipng Plover-Endangered	8	8.00	2.14	37	9	6.67	3.20	36	8	6.00	3.12	38	8	2.13	2.47	45	9	0.22	0.44	47
Harkers Island Marina	7	8.71	1.60	38	7	7.86	2.34	37	7	8.29	1.80	36	7	7.86	3.67	36	7	4.86	4.10	32
Maint. & Equip. Bldgs.	8	6.38	3.34	39	8	3.63	1.51	41	8	5.00	2.56	40	8	9.00	1.20	34	8	7.50	1.41	24
Sea-Beach Amaranth-EP	5	8.80	2.38	40	4	7.50	3.00	40	4	6.50	3.11	42	3	5.67	5.13	45	4	1.50	3.00	46
RV Dump Stations	8	5.25	3.88	41	9	3.11	3.95	42	9	4.89	4.20	39	8	5.75	3.77	39	9	7.56	2.88	20
Bridges	5	8.00	3.08	42	5	6.60	3.21	39	5	8.00	3.46	41	5	8.40	3.58	40	5	6.40	3.29	35
Fuel Storage Areas (4)	6	5.33	4.08	43	6	3.17	3.71	44	6	3.67	4.23	44	6	8.33	2.34	38	6	8.83	1.17	26
GI Generator Shed	4	7.00	2.45	44	5	1.20	1.10	47	5	2.00	1.58	46	4	5.50	4.80	44	5	9.20	0.84	29
Administration Building	4	6.00	4.32	45	4	3.00	4.76	45	4	4.25	4.19	45	4	9.25	1.50	41	4	8.25	1.26	33
Ranger Cabins at LP (2)	3	8.00	1.73	46	3	8.00	2.65	43	3	8.67	1.53	43	3	9.00	1.73	43	3	4.33	4.93	42
Ranger Cabins at GI Camps	2	6.50	2.12	47	2	4.00	1.41	46	2	2.50	0.71	47	2	7.50	2.12	47	2	8.50	0.71	41
CL=Cape Lookout, PV = Portsmouth Village, GI = Great Island,LP = Long Point, EP = Endangered Plant, Env. Environmental																				

Table 1. Descriptive Statistics for Each Resource.

4.2. Creating a Value-Space

The mean rating of each resource can be considered a distributional measure of the importance of each resource to "fundamental character," "attracting visitors," "scenic beauty," "ability to operate," and "ability to replace." It might be expected that the mean ratings of resources selected among the top-ten for the place would be concentrated in the upper end of the zero-to-ten scale. Table 1 shows the mean ratings throughout the scale. For example, the Piping Plover's

(Charadrius melodus) mean rating is a 0.22 on ability to replace and 2.13 on importance to operations. Meanwhile, the Keeper's Quarters is 8.82 on importance to character, 6.68 on importance to operations, while only and 1.16 for ability to be replaced. These ratings assess each resource with respect to a common eleven-point scale with a meaningful zero of "not at all important" or "not able to be replaced", and a maximum of ten reflecting "extremely important" or "easily replaced". While this measure has the apparent quality of interval measurement, there is no assurance of equal intervals, but it will be henceforth treated as if it is an interval measure.

The relative ranking of each resource for each value type provides a second measure for the value associated with each resource for each value type that is relative to the other resources selected. The ranking is interval in that it is the rank of each resource compared to all other resources selected by at least two respondents. It ranges from one for the most important resource to 47 for the least important resource with respect to the value type under consideration. The ranking is based on the "importance-points" each resource was given by respondents, which are the product of the number of respondents selecting each value and the expressed-value. For example, if ten respondents assigned an importance of nine, there would be 90 value-points; or if 100 respondents make this assessment, it would result in 900 value-points. It also means that 90 people assessing the importance at ten is exactly the same value as ten respondents assessing the importance a nine. Ratings that resulted in equal number of importance-points for two resources were subsequently assigned unique ranks based on the number of respondents selecting the resources, where more people selecting a resource ranked higher than the less frequently selected resource. While stemming from the ratings of each value type, the resource rankings are relative to each other rather than the zero-to-ten scale. The resulting ranking is interval in that it is the count of resources from most important (rank 1) to least important (rank 47). Each interval in the ranking represents one resource, such that the difference between any two values is calculable in term of the number of intervals (or resources) ranked between the two ranks.

5. Findings

It is hardly surprising that the importance to character, scenic beauty, visitation, and operations for all top-ten resources receive high average ratings—8.2, 7.2, 7.5, and 6.7 respectively. After all they were selected because they were considered the ten-most important resources. The ability to be replaced was rated as 3.8 on average. The top nine resources are ranked the same by character, scenic beauty, and visitation, and eight of the top nine are also in the top nine for operations. In a similar vein, the bottom nine resources by character, scenic beauty and visitation include the same resources although they are not in the same order, and the rankings on operations includes seven of the same nine resources. The rankings on ability to be replaced share top-ten status with character, scenic beauty and visitation only for the Cape Lookout Lighthouse, while the Ranger Cabins at Long Point and Great Island, and the Sea-Beach Amaranth (Amaranthus pumilus) are the least able to be replaced and have bottom-ten rankings on character, scenic beauty and visitation. The Pearson Correlations among the value-type measures are presented in Table 2. As would be expected the mean rating and the rankings are inversely related. When the correlations are strong as they are for character, scenic beauty, and visitation, the mean ratings and rankings are related. But when the correlations are weaker as they are for operations and ability to replace, the indirect relationship weakens as well.

Ratings	C	SB	V	O	R
Character (C)	---				
Scenic Beauty (SB)	0.883	---			
Visitation (V)	0.790	0.834	---		
Operations (O)	NS	NS	NS	---	
Replaceable (R)	-0.746	-0.861	-0.552	0.571	---
Ratings/Ranking	**C**	**SB**	**V**	**O**	**R**
Character (C)	-0.620				
Scenic Beauty (SB)	-0.669	-0.746			
Visitation (V)	-0.600	-0.656	-0.665		
Operations (O)	-0.506	-0.548	-0.623	-0.092	
Replaceable (R)	NS	NS	NS	-0.416	-0.400
Rankings	**C**	**SB**	**V**	**O**	**R**
Character (C)	---				
Scenic Beauty (SB)	0.986	---			
Visitation (V)	0.995	0.981	---		
Operations (O)	0.962	0.932	0.969	---	
Replaceable (R)	0.415	0.331	0.458	0.580	---

Table 2. Pearson Correlations among value-type ratings, between ratings and rankings, and among rankings.

The strong correlations among importance to character, scenic beauty and visitation for both the mean rating and the ranking seem to indicate that these value-types are sharing the value-space to some extent. The weaker correlations between these three measures and importance to operations indicates unique contribution to the value-space. While the stronger negative correlations between these three and ability to be replaced indicates some limited overlap with character, scenic beauty and visitation, but in the other (although not opposite) direction. The importance of operations is not significantly correlated with any other measure except the ability to replace, which accounts for about one-fourth of the overall variation. This suggests that both operations and ability to be replaced may be contributing independently to the overall value-space.

The factor analysis results revealed two principal factors (with eigenvalues of 3.23 and .89 respectively). The first factor explains most of the variance in the value space (80.7%) and has high factor loadings on fundamental character (.901), scenic beauty (.980) and visitation (.864). The second factor accounts for the remaining variance (22.2%) with high loadings on the ability to operate (.728) and able to be replaced (.521). The eigenvalues and the zero additional explained variance after two factors confirm a two-factor value-space. A graphic representation of the resulting value-space is depicted in Figure 3. This value-space is standardized both horizontally and vertically. Each resource is depicted in the value-space relative to all others. The x-axis of the value-space seems to carry an underlying abstract character associated with aesthetic quality—the left-most resources with limited aesthetic quality including maintenance sheds, fuel storage and waste disposal areas, and administration buildings, while the right-most resources have a high degree of aesthetic quality including aesthetic environmental experiences, the Shackleford Banks Horses, the Cape Lookout Lighthouse, salt marshes, and dune and beach systems. The y-axis of the space seems to be associated with a functional quality—with dockage, vehicles, roads, cabins and cottages having positive factor scores, and Piping Plover, historic cemeteries and Beaufort's Bottlenose Dolphins (Tursiops truncates) on the negative side. Generally, positive factor scores reflect infrastructural resources with an emphasis on logistics and function, while negative scores reflect historic, cultural and environmental resources, with endangered species being the most negatively located. Infrastructural resources dominate the upper-left quadrant—no other resource types are located in this quadrant. Cultural resources, along with many environmental resources, dominate the lower-right quadrant. Endangered species tend toward the middle of the aesthetic quality but are extremely low on infrastructural function as reflected in their importance to operations and ability to be replaced.

		Aesthetic Quality	Functional Quality
		Factor 1	Factor 2
Mean Ratings	Eigenvalue	3.230	0.887
	Character	0.901	0.001
	Scenic Beauty	0.980	-0.074
	Visitation	0.864	0.284
	Operations	-0.208	0.728
	Replaceability	-0.818	0.521
	Variance Explained	.807	.222

Cronbach's Alpha = 0.84.

Shaded cells contain loadings > .05, which reflects loadings that dominate the factor.

Table 3 Factor loadings for the value-space of mean ratings (quartimax rotation).

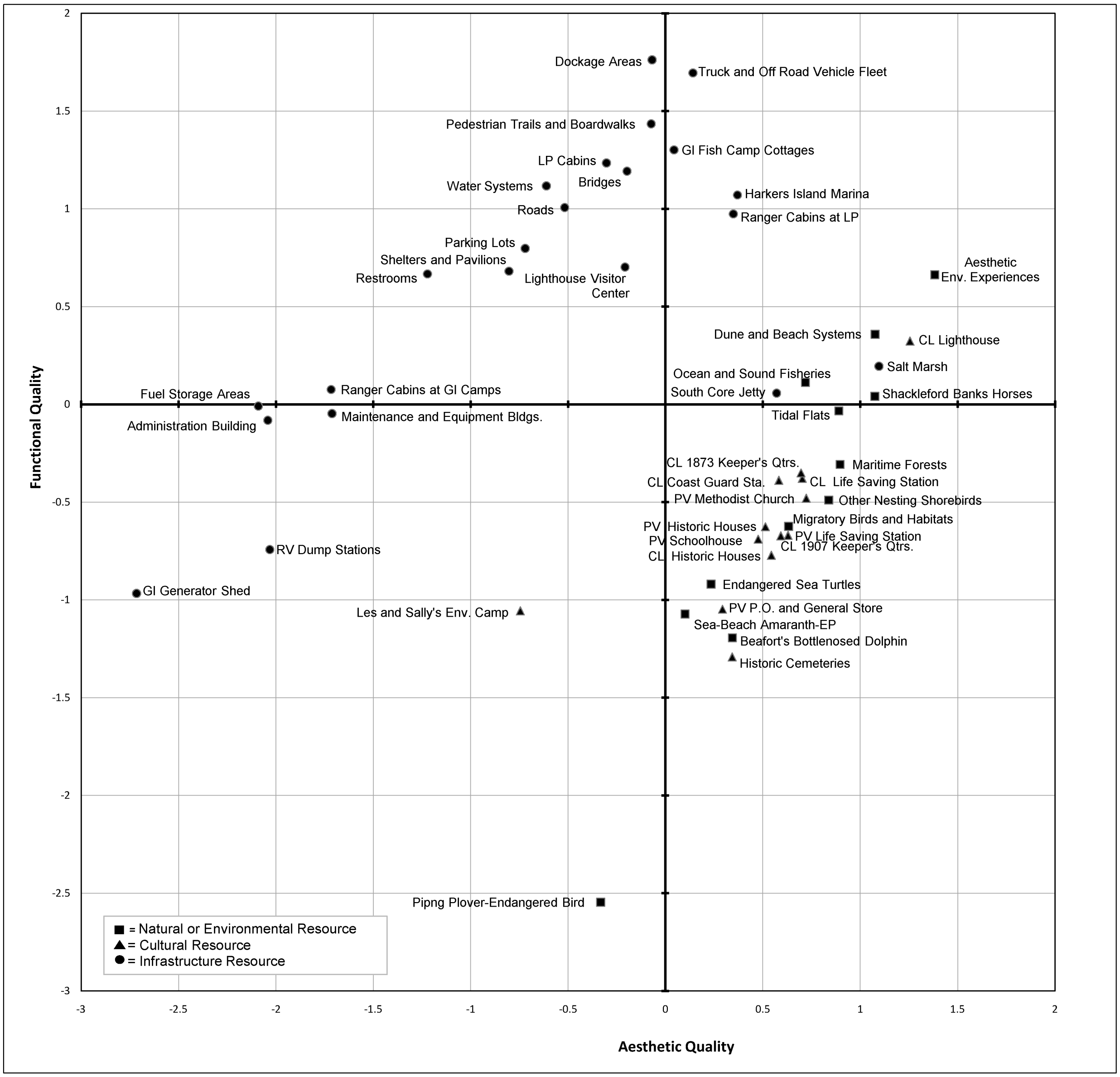

Figure 3 Value-Space

6. Discussion

While each resource is valued individually, they are valued in the context of the place. The value of the park is more than any single resource (or for that matter) the sum of all resources. The uniqueness of the place lies in the interconnections among resources, their independence, codependence, and the subtle combination of resources that combine to create a unique whole. Like the combination of spices in a gourmet meal coming together subtly to form the whole, the resources of a place combine to create value-space associated with the place. This can be seen as the “capital” upon which the park draws in order to provide recreational and cultural services (Hawken et al., 1999). As multiple dimensions of value are brought together in a complex admixture, these subtleties become more intricate and unique; and the value of the place increases. The two-dimensional value-space presents the pattern of relationships between resources relative to one another that inform resource management, environmental planning, and policy.

As reported above the all resources represented in the upper-left quadrant of the value-space are infrastructural, and 57.1% of all infrastructural resources are located in this quadrant. Cultural resources, along with many environmental resources, dominate the lower-right quadrant, with 84.6% of cultural resources and 60.0% of the environmental resources being located in this quadrant. Endangered species tend toward the middle of the aesthetic quality. Specific endangered species are located near the bottom-middle of the value-space, with near-zero aesthetic quality and negative functional quality. This seems to reflect the intrinsic nature of endangered species. The endangered species are neutral to the observable aesthetic quality as less likely to be experienced directly than other environmental resources (e.g., maritime forests, dunes and beaches, and salt marshes), which are more positively located with respect to aesthetic quality. This is consistent with the idea that endangered species have value beyond simple mortality as irreplaceable indicators of environmental health. They are valued as once-gone-forever-lost resources that have value because of their mere existence, even if they are never directly experienced. The Shackleford Banks Horses, Cape Lookout Lighthouse, Maritime Forests, Dune and Beach Systems, Tidal Flats, and Salt Marshes are more likely to impact directly an aesthetic environmental experience than endangered species; and these aesthetic environmental experiences are characterized by strongly positive aesthetic quality and near neutral functional quality.

The place-based resource-driven method of valuing resources presented herein is clearly within the realm of participatory valuation. It represents a specific systematic method to quantitatively codify the nature of values associated with a place and treats identifiable resources as the objects of value in the place. In the development of various objectives and alternatives, the value-space identifies resources of similar value, which help to define, shape and establish the nature of the problem. Decision and policy makers, planners and resource managers can use the value-space to associate, or disassociate outcomes and alternatives. For example, the case of Cape Lookout, resource managers are well aware of the central role of the Cape Lookout Lighthouse and the Shackleford Banks Horses, but may be less aware of the similarity of the role that salt marshes, dune and beach systems seem to have in establishing aesthetic environmental experiences. The value-space also helps resource managers and policy makers determine the boundary of the problem and potential solutions. For example, the geographic impact zone of the Cape Lookout Lighthouse is quite large—encompassing not only the visible-line-of-sight, which is large; but it has become a symbolic icon of the entire region, which is even larger. These impacts of resources often extend beyond geographic boundaries (e.g., the park boundary) well into contextual boundaries, which the value maps can clarify. Another decision criterion might consider the extent to which the various alternatives treat resources that are grouped together in the value-space in a similar fashion. The place-based method discussed herein establishes communities-of-resources that either hold similar value to the place or are grouped geographically, which highlights the consequences of environmental choices.

The place-based resource-driven valuation provides decision processes with a methodology that codifies, quantifies and visualizes the relationship between resources and underlying values. This process:

- establishes an inventory of resources (e.g., natural, cultural and infrastructural) that are of value to the place;
- establishes the full-range of potential types of value associated with significant resources;
- quantitatively assesses the significant resources of the place for each type of value and any potential interactions among value-types;
- provides insights that shape boundary conditions, and impact zones for each resource and the place as a whole;
- visually illustrates similarities and differences among resources in terms of the underlying value-space; and
- establishes communities-of-resources within value-structures.

Natural resource managers, environmental planners, and cultural resource guardians are often faced with decisions that require assessment of non-market values. While these intrinsic values are recognized as important, efforts to account for them often rely on qualitative interpretation of the significance and value of these resources. The place-based resource-driven method presented herein, supplements these methods by quantifying the value associated with these resources along multiple dimensions. It places them on equal footing with expressed-preference based methods (e.g., contingent valuation or willingness-to-pay). Moreover this approach affords the direct examination of the relationship between these value assessments.

7. Conclusion

This article presents a pilot effort to identify a methodology to more efficiently codify, quantify and illustrate the intrinsic values associated with natural and cultural resources. The benefits of analyzing a single national park such as Cape Lookout National Seashore include, a definitive boundary within which to operate, a pre-existing inventory of natural and cultural resources, and a highly knowledgeable dedicated park staff to inform the process. This research has taken advantage of these benefits, while minimizing the burden on park staff and stakeholders. While the research process allowed spontaneous addition to the list of resources considered, few resources were added and none were found significant. Hence the focus of this research has been on the valuation of the pre-existing natural and cultural resources of the park. Through iterative discussions with park staff a set of five value-types were considered. Natural and cultural resources selected among the top-ten by stakeholders were rated through a web-based survey. Factor analysis of these data for the selected resources confirms the existence of multiple dimensions of value. Factor analysis is particularly well-suited for this endeavor as it, (a) focuses on significant dimensions by selecting the factor that accounts for the most variance in the joint distribution of resources, iteratively followed by the additional factor(s) that account for the most remaining variance, (b) selects dimensions that are orthogonal to each other and thereby independent of each other, and (c) converts all values to a standardized metric which facilitates comparison. The resulting value-space has two dimensions that are connected, at least loosely, with aesthetic quality on the horizontal-axis and functional quality on the vertical-axis.

The present effort is pilot research intended to explore the potential to measure the values associated with natural and cultural resources in multiple dimensions. While it has shown that multiple dimensions of value can be measured quantitatively, it represents only one national park where a concentration of cultural and natural resources exists and is located primarily on barrier islands with no bridges. It is not possible to know from these results the extent to which these values generalize to similar parks, parks with similar resources and greater access, parks that encompass communities, other kinds of parks, or communities in general. This effort took advantage of extensive discussions with long-term park staff members in developing the types of values that were likely to be associated with park resources, but this could mean that other kinds of values may have been inadvertently omitted (e.g., peace and tranquility, repository of biodiversity or cultural heritage, or economic stimulus). While it is clear that selected value-types, because they are finite, will always exclude potential alternative value-types, a systematic approach involving all stakeholders would help assure that the range of value-types considered represent the full-range of potentially important values. As a pilot study this research draws on a limited sample, but results in a relatively shared value structure that includes an adequate number of resources to support the analysis. Without the park to focus and sharpen public attention on specific natural and cultural resources, more diffuse value structures may prove difficult to characterize in terms of vague or loosely associated resources (e.g., the people, our children, leadership or friendliness).

Future research will extend the present effort by examining various parks and their resources. This research will begin to clarify the extent to which the pattern of resources is stable or variable, unique or shared, global or local. Future research will specifically address the extent to which these results can be generalized. The extent to which parks with similar resources under various conditions share common elements of the value-space, and the extent to which the value-spaces are unique is an important guide to the kinds of policies and plans that are likely to meet with success in the National Park Service as a whole. The extent of temporal stability of the value-space is an important determinant of the ongoing need for public participation. Similarities and differences among groups' value-spaces can inform resource managers about appropriate actions. For example, comparing the value-space for two or more groups of various interests may be used to inform conflict resolution efforts. The impacts of climate change are expected to have serious impacts on barrier island parks. Future research following the approach developed herein makes it possible to preview impacts to the overall resource-base as various resources are lost or threatened (e.g., to sea level rise, hurricane damage, or tidal surges). Some resources have the potential to be protected or moved to safer locations, others may relocate naturally; still others may be restored or reconstructed as replicas of historic resources. The place-based resource-driven approach allows for these potential outcomes to be quantified so that impacts on various resources and alternatives can be compared. Such comparisons can be achieved in the context of their geographic location(s) and the potential area of influence associated with that resource (e.g., through view-sheds, or access zones). In other words each resource can be located on a geographic map, and the impact zone considered (e.g., perhaps values depicted as contours on the map), so that resources can be bundled with their values in decision making and planning.

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