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From economic choice to social choice in coastal management: A critical assessment of the use of cost-benefit analysis in the evaluation of an erosion control project in Flagler County, Florida, U.S.A.

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A B S T R A C T

Sustainable development remains of general interest in both political and academic circles. Importantly, the approach to collective decision making adopted in pursuit of sustainable development has importance repercussions regarding what range of possible informational considerations get incorporated as relevant to a given choice exercise. The most dominant approach to environmental public policy assessment, which I discuss under the rubric of *economic choice*, is interested in maximizing utility, measured in monetary metrics, and evaluates alternatives using cost-benefit analysis (CBA). CBA is a process which requires the quantification and monetization of all relevant considerations, a tendency which some critics suggest makes the outcomes of this technique inaccurate, exclusionary and negligent of the question of distribution. While these criticisms are practically important, they are also theoretically manageable within the economic choice approach, requiring improvements in its use rather than its abandonment. In contrast, I advance a different kind of criticism aimed at identifying contradictions internal to the economic choice approach itself which can only be resolved by rejecting its basic assumptions and replacing them with better ones. In particular I point to the inadequacy of the underlying assumption inherent in economic choice that income is a satisfactory representation of human well-being. Instead, drawing on Amartya Sen's capabilities approach, I argue for the superiority of conceptualizing well-being in terms of the substantive freedoms and capabilities people actually have to pursue lives they have reason to value. This alternative approach, which I discuss under the rubric of *social choice*, has the capacity to incorporate informational considerations emphasized by economic choice; however, it is superior to economic choice because it can also incorporate a wide range of other informational considerations based on a plurality of reasons; that is, without the need to reference their contribution to income metrics specifically. The economic choice approach and social choice approach are compared and contrasted both theoretically and practically in relation to a coastal erosion control project currently being planned by the U.S. Army Corps of Engineers in Flagler County, Florida, U.S.A.

1. Introduction: sustainable development and collective decision making

Sustainable Development (SD) has been the focus of substantial political (Scoones, 2016) and scientific (Kates, 2011) attention over the last three or so decades, most recently evidenced by the introduction of the UN Sustainable Development Goals which came into effect in January 2016. Broadly defined as "meet[ing] the needs, now and in the future, for human, economic, and social development within the restraints of the life support systems of the planet", what Kates et al. (2005, p. 20) called the "creative ambiguity and openness to interpretation" which characterizes the SD concept has led to significant political and scholarly debate over how to operationalize it in practice. These debates include which decision making procedures should be adopted in pursuit of SD as well as what metrics are most appropriate for measuring SD progress.

When considering the possible decision making procedures one can adopt in the pursuit of SD, it is, broadly speaking, useful to think in terms of three stylized decision making models (see Faran, 2010, p. 1): economic choice, operationalized through cost-benefit

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analysis; political choice, operationalized through majority rule; and social choice, operationalized through a process of interpersonal comparisons and public deliberation. Each of these choice procedures is underpinned by a particular informational basis, meaning "the information that is needed for making judgments using that approach and – no less important – the information that is "excluded" from a direct evaluative role in that approach" (Sen, 2001, p. 56). Economic choice is based on economic metrics, in particular the calculation and comparison of monetary costs and benefits. Political choice is based on the greatest number of votes cast in favour of a particular alternative in free and open elections. Social choice is based on a consideration of a range of evaluative weights. In this article, I will be dealing explicitly with economic choice and social choice, the first being the most dominant approach adopted to evaluate environmental public policy and projects in the United States and the second remaining a promising yet still marginal alternative. While I do not directly address the political choice approach, the fact that scholarship conducted under the rubric of social choice is generally geared towards overcoming the shortcomings of political choice justify my refrain from detailed discussion of the latter. Instead, I offer a very brief reminder of the shortcomings of political choice regarding its capacity to produce socially beneficial outcomes (as opposed to individual or factional benefits), which have been well-known for centuries, before moving on to social choice as an alternative.

Each of these choice procedures, and the informational considerations they are based on, also reflect other assumptions inherent to each particular mode of thinking. Here, I consider specifically those assumptions which pertain to the conceptualization of SD and how best to measure it. In particular, economic choice uses monetary metrics, which translates into SD being linked with aggregate increases in the national output of goods and services, measured in economic terms, for example, GNP or income per capita, which are seen as indicators of social well-being. On the other hand, social choice, in particular the capability approach developed by Amartya Sen (see Sen, 2001) which I rely on here, links SD to the expansion of substantive human freedoms, measured in terms of the capabilities people actually have to pursue lives they have reason to value. In order to tease out the most fundamental differences between these approaches, I assess an ongoing coastal management project being planned by the U.S. Army Corps of Engineers in Flagler County, Florida, in terms of both approaches. The first approach, economic choice, is the approach adopted by the Army Corps itself, while the social choice approach is advanced as a potentially superior alternative.

While economic choice enjoys wide-spread currency as the dominant choice model actually used in environmental policy evaluation, many have weighed criticisms against this approach, identifying a variety of problems related to both process and outcomes. However, the problems identified by critics of economic choice are often the result of the contingencies of the context or practical application of the cost-benefit analysis method rather than the result of internal contradictions or inconsistencies in the logic of the approach itself, meaning such "problems" are theoretically manageable within the economic choice approach. This is the case, for example, with criticisms of the accuracy of cost-benefit calculations. Additionally, other criticisms focus on issues which, while important in many ways, formally fall outside the boundaries of consideration of the economic choice approach and thus only constitute "problems" from an external perspective. This is the case, for example, with claims that the approach neglects the question of distribution.

However, in contrast to these theoretically manageable or externally imposed criticisms, I advance an understanding of the limitations of the internal, constitutive assumptions at the core of the economic choice model, in particular its basic assumption about what constitutes well-being and how it is best represented in terms of monetary metrics. Such an internally-sourced contradiction can only be solved by abandoning these assumptions and replacing them with better ones, which I suggest the social choice model advanced by Sen's capabilities approach can provide. In particular, the replacement of income growth as the measurement of development with the explicit focus on human freedoms and the capabilities that sustain them breathes new life into these old criticisms, reframing their significance in terms of their constitutive role in advancing human freedom as well as connecting their resolution to the adoption of a superior alternative social choice-based decision making procedure. When moving from economic choice to social choice, the significance of particular considerations in evaluating environmental policy shift from a focus on their contribution to income to their contribution to freedom, a shift itself which introduces powerful arguments in support of meaningful public participation and environmental conservation.

2. Methodology and data collection

2.1. The method of immanent critique

There are two ways one can go about evaluating a given decision making procedure. The first is to judge to what degree that decision making procedure fulfils some externally imposed criteria of success, for example how far it goes in fulfilling a particular conception of justice or fairness. The other option, which is the one I employ here, is to see to what degree a particular decision making procedure fulfils *its own* criteria of success, that is, the criteria internal to the decision making procedure itself. This latter approach is best described as "immanent critique", which Roy Bhaskar (2010, p. 21) defined as a mode of critical analysis premised on "taking a system of thought on its own terms [and] showing how it involves various internal contradictions and aporiai". Taking a system of thought "on its own terms" means that, rather than imposing external criteria on a given way of thinking as means to judge it, an immanent critical approach advances understanding by demonstrating the conceptual limits of a given system in terms of its own logical structure and assumed content. This mode of reasoning has much to do with dialectic, which, as Robert C. Solomon (1985, p. 23) has put it, involves:

> the process of discovering the limitations of various [conceptualizations], in part through the recognition of their contradictions-both internal and external- and thereby coming to see more adequate forms of [conceptualization] that resolve these tensions.

Immanent criticism, importantly, is not purely negative, but plays a positive role as well in that by identifying internal and external contradictions stemming from a particular mode of evaluation, one is able to draw conclusions about which conceptual and practical adjustments need to be made to remedy those residual tensions (see Macintyre, 1996, p. 203). In this article, I begin in the negative vein by examining the use of the economic choice approach by the U.S. Army Corps of Engineers in their evaluation of a beach nourishment project in Flagler County, Florida. I start by assessing the project in terms of those commonly levelled criticism regarding accuracy, inclusion and distribution. This includes the argument that the manifestation of these problems in the process and outcomes of the Army Corps project are related to contextual application of the cost-benefit analysis technique and thus contingent, as well as how these problems may be addressed from within the logic of economic choice.

I then switch to an immanent criticism of the economic choice approach. In particular, I assess how far the self-imposed informational limitations of economic choice are able to actually provide the benefits (i.e. increases in well-being) it assumes are being provided, emphasizing in particular that economic choice can only incorporate those issues pointed out by critics in terms of their contribution to economic (e.g. income) metrics, which is itself shown to be a severely limited indicator of well-being. This leads to the need for a broadening of informational basis considered in SD evaluations. Building on the recognition of these residual contradictions in economic choice, I then shift to a positive vein by presenting an alternative decision making procedure which is able to incorporate the informational considerations of economic choice without suffering from the same residual problems. In doing so, I move from critique of existing modes of evaluation to the prescription of a promising alternative.

2.2. Data collection

The method of immanent criticism involves the identification of both theoretical and practical contradictions. The latter involves assessment of project procedures and outcomes in relation to a real-world situation, which in this case involves the problem of critical erosion in Flagler County and the proposed Army Corps of Engineers Hurricane Storm Damage Reduction Project. In sourcing evidence for my argument, I draw on data collected both through desk-based research and through three field visits to Flagler County undertaken between 2013 and 2017. Field data collection involved three primary sources. The first involved the purposive interviewing of elected officials at city and county levels. Second involves the collection of project documents from county and city authorities related to the Army Corps' project planning process and outcomes. This involved in particular getting access to the Army Corps project feasibility study (USACOE, 2014), the principle report outlining the project process and outcomes released in January of 2014, as well as a variety of supplementary materials related to Army Corps planning process as well as county and city residents' and elected officials' interactions with the Army Corps.

For the final data source, I conducted a citizen survey, in collaboration with the City of Flagler Beach, to inquire about the general public opinion regarding a variety of beach management issues, including public prioritization of beach management problems, levels of public awareness of and participation in beach management activities, the desirability of various routes of communication between local government and citizens regarding beach management information, and citizen perspectives on management responsibility. The citizen survey was a 13 part questionnaire, with 10 multiple choice and 3 free-answer questions. The survey questions were formulated around the central themes identified in the Flagler Beach *Beach Management Plan* related to issue prioritization, awareness, participation, communication and responsibility (Beach Management AD HOC Committee, 2015). Multiple choice questions were organized using Likert Scale anchors (e.g. High, Medium, Low). The survey was intended specifically for citizens of Flagler Beach, which was indicated on the survey cover letter. The survey was conducted between January 2016 and April 2016 and raw data was processed using the online survey provider SurveyMonkey (surveymonkey.com). The survey link was disseminated via social media and the City of Flagler Beach Homepage, resulting in roughly 155 responses. Hard copies of the survey were also mailed to Flagler Beach citizens through a municipal utilities bill insert and then later submitted as online entries once returned by respondents to City Hall, resulting in roughly 240 additional responses for a total of 395 (the total population of Flagler Beach is approximately 4500). The multiple choice questions were then processed for basic trends in public opinion. Open comments were also analysed and thematically organized for further evaluation. The survey results function as a general indicator of the spectrum of citizen perspectives.

In addition to these primary data sources, the arguments in this article draw heavily on peer-reviewed and other scholarly research, grey literature (e.g. congressional reports), as well as local newspaper articles which directly pertain to the beach management issue in Flagler County. I in particular draw substantially from Sen (2001) book *Development as Freedom* (Sen, 2001).

3. Sustainability, cost-benefit analysis and the logic of economic choice

The economic choice approach to evaluation prioritizes the maximization of aggregate utility when choosing between competing priorities. This evaluative approach provides the core strategy for operationalizing what some have called the "weak sustainability" approach to sustainable development (see Faran, 2010). The main idea in weak sustainability is that current and future well-being, the maintenance or expansion of which is the avowed purpose of development, is a factor of over-all productive capacity of society which relies on the total stock of capital, and this is what needs to be sustained in the long term. Accomplished economists Robert Solow (1993, p. 168) state's the matter clearly:

> The standard of living achievable in the future depends on a bundle of endowments, in principle on everything that could limit the economy's capacity to produce economic well-being. That includes non-renewable resources, of course, but it also includes the stock of plant and equipment, the inventory of technological knowledge, and even the general level of education and supply of skills. A sustainable path for the economy is thus not necessarily one that conserves every single thing or any single thing. It is one that replaces whatever it takes from its inherited natural and produced endowment, its material and intellectual endowment. What matters is not the particular form that the replacement takes, but only its capacity to produce the things that posterity will enjoy.

Solow, like many economists, conceptualizes natural resources in the same way as any other man-made resource, that is, in terms of capital (see Stern, 1997). "A pool of oil or vein of iron or deposit of copper in the ground" Solow (1974, p. 2) tells us:

> is a capital asset to society and to its owner (in the kind of society in which such things have private owners) much like a printing press or a building or any other reproducible capital asset. The only difference is that the natural resource is not reproducible, so the size of the existing stock can never increase through time. It can only decrease (or, if none is mined for a while, stay the same).

In this way, natural and manufactured capitals are conceptualized as essentially the same when it comes to their role as capital input to the economy. In fact, Solow insists that it is "absolutely vital" that capital be conceptualized in very broad terms, including, in his words "everything, tangible and intangible, in which the economy can invest or disinvest, including knowledge" (Solow, 1993, p. 169). The logical implication of this position is that, in order to maintain or increase the general productive capacity of society, neither manufactured nor natural capital in particular must be preserved, but only the total stock of capital. "Once that principle is accepted", says Solow (1993, p. 168), "we are in the everyday

world of substitutions and trade-offs." Following this, the criteria for deciding whether a substitution or trade-off should take place is whether or not the decision increases the total capital stock and thus leads to an increase in the over-all productive capacity of society, which is measured in GNP per capita (or some other aggregate economic indicator). Regarding the choice of indicator, as Solow (1993, p. 167) points out, the focus on national product is not arbitrary, but derived from the logic of capital itself: "The very logic of the economic theory of capital tells us how to construct a net national product concept that allows properly for the depletion of non-renewable resources, and also for other forms of natural capital." In the final analysis, increases in the net national product indicator, the theory goes, reflects improvements in well-being in society over-all, even if some nature is "degraded" in the process.

The basic logic of economic choice implies the need to assess the potential differences in utility likely to be accrued by a given set of alternative options. To this end, cost-benefit analysis (CBA) is widely employed for purposes of environmental policy evaluation in the United States (Rose-Ackerman, 2010). The adoption of cost-benefit analysis as a core decision making tool in the U.S. goes back well over a century and is affiliated with the increasingly important role of the Army Corps of Engineers as a public resource manager, its tensions with other federal agencies and the need for establishing "objectivity" in decision making. As historian Theodor Porter (1996, p. 149) explains:

> the historian of bureaucracy does not portray the Army Corps at the centre of an administrative ruling class, but in a scene of utter disunity and savage infighting. This, I argue, is the appropriate context for understanding the pursuit of uniform cost-benefit methods. That form of economic quantification grew up not as the natural language of a technical elite, but as an attempt to create a basis for mutual accommodation in a context of suspicion and disagreement.

In very general terms, CBA is a multi-stage process of valuation and assessment by which projects can be compared in terms of their relative ratios of utility to dis-utility. Such a comparison allows for the possibility of maximizing utility in decision making, namely by selecting those projects with the most favourable utility to dis-utility (or benefit to cost) ratio. The maximization of utility is ensured through quantification and comparison of all relevant costs incurred and benefits accrued as the result of alternative actions. In doing so, one fundamental requirement is that "all [benefits and costs] thought to be relevant are measured in the same units, otherwise they cannot be added together (aggregated), either across people or over time" (Hanley et al., 2009, p. 15). This equivalency unit, as previously mentioned, is typically monetary. (Marx famously called money the "universal equivalent"). For goods or services which already have market prices, these prices can simply be used in calculating costs and benefits. When non-market goods or services are concerned, which is often the case with environmental goods and services, then various valuation techniques, such as contingent valuation, hedonic pricing, travel costs, etc., can be used to assign a monetary value to them. Furthermore, since benefits and costs must be measured in present values to provide an adequate, contemporary economic basis of comparison for decision-making purposes, the use of discounting of future values is common practice.

In addition to these basic valuational requirements, because CBA calculations fundamentally rely on quantification of *net* benefits, the need to "predict the future" arises for when projects have temporally dispersed impacts, as environmental projects often do (Pilkey and Pilkey-Jarvis, 2007). In such cases, environmental project planners in the Army Corps and other agencies aim to predict future changes to earth systems, for example future rates of erosion, as well as attempt to accurately quantify these changes and translate them into monetary values. For this purpose, Army Corps project planners, like many others, turn to quantitative earth systems model predictions which incorporate a variety of information inputs into a mathematized model of the system concerned in order to simulate possible system changes and their likely economic impacts (e.g. damage costs). This requirement to translate all relevant considerations into a single (monetary) indicator as means to assess individual projects or compare between competing alternatives lies at the heart of both the advantages proclaimed by the proponents of economic choice and CBA, as well as the criticisms levelled by its discontents.

3.1. Economic choice and its discontents

Proponents of CBA generally provide two basic arguments in its favour, first that CBA leads to the most efficient allocation of societal resources and thus to the greatest contribution to well-being and, second, that CBA provides for more objective and transparent decision-making (Heinzerling and Ackerman, 2002, p. 8–10). To live up to these goals, CBA requires reduction, quantification and monetization. Significantly, it is precisely this reductionist feature of CBA which critics argue reduces its usefulness as a tool for choosing between competing alternatives in environmental public policy (Anderson et al., 2015; Hockley, 2014; Rose-Ackerman, 2010; Pearce, 1998; Pilkey and Dixon, 1996). Heinzerling and Ackerman (2002, p. 11) for example identify four flaws stemming from the methodology of CBA which are widely shared among critics:

1. The standard economic approaches to valuation are inaccurate and implausible.
2. The use of discounting improperly trivializes future harms and the irreversibility of some environmental problems.
3. The reliance on aggregate, monetized benefits excludes questions of fairness and morality.
4. The value-laden and complex cost-benefit process is neither objective nor transparent.

Along these lines, some, for example Sen (1995a, p. 28), have emphasized the various potential problems with valuation techniques which can severely skew the price assigned to environmental concerns in evaluation processes, such as the tendency for citizens to wildly over estimate their willingness to pay for avoiding a hypothetical environmental harm. Still other critics draw attention to cases where the systematic overestimation of costs and under-estimation of benefits have been used by special interests to prevent or dismantle environmental regulations, such as controls on environmental toxins, and the de-railing of conservation efforts, such as forest preservation initiatives (Ackerman and Heinzerling, 2002).

Criticisms levelled at accuracy and honesty, while important, are technically speaking not problems internal to economic choice or CBA itself, but rather regard the use of insufficient techniques or the intentional manipulation of quantification exercises. While, as we will see in the case of Flagler County below, such potential problems in the application of economic choice can lead to real and meaningful complications, this reality does not preclude the theoretical possibility of addressing these problems by applying more accurate valuation techniques. Furthermore, the "problem" of aggregation and the neglect of distribution, while again potentially leading to real and meaningful problems in practice, are formally external to the economic choice strategy. Being explicitly predicated on the maximization of aggregate utility, economic choice never promises to "fairly" distribute outcomes, but only to ensure

aggregate increases in well-being. As a result, the economic choice approach cannot be formally held accountable for issues it is predicated on disregarding. However, as we will see, more internal criticisms do exist, and they have to do with the underlying assumption in economic choice that income is an appropriate metric for well-being, and that topics of concern which do not influence income generation are therefore excluded from consideration or only included in so far as they contribute to increases in income (or some other utility indicator). That is, they are only included based on their *instrumental* role in income generation, not because of any constitutive role they play in the process of development itself.

4. Case study: the Army Corps' Flagler County hurricane and Storm Damage Reduction Project

4.1. Case context

Flagler County is located in North-eastern Florida, U.S.A., and is lined on its Atlantic coast by a populated barrier island. Within the county, the City of Flagler Beach is relatively small city (ca. 4500 inhabitants) located on the barrier island and is the focal point of a planned Army Corps of Engineers coastal protection project. The local barrier island dune system has long experienced critical erosion, a wide spread and growing problem throughout Florida (Florida Department of Environmental Protection, 2016), which threatens an historical and scenic state road, State Road A1A, which is considered to be significant for the local and regional economy because of its role in providing tourism access, as well as serving as an evacuation route for the citizens of the barrier island (Boda, 2015).

In 2002 the Army Corps began investigating Flagler County to see if there would be federal interest in addressing the county's critical erosion problems which eventually led to the creation of the Flagler County Hurricane and Storm Damage Reduction Project (from here on, the Flagler Project). The purpose of the Flagler Project, as its name suggests, is to provide damage prevention from coastal hazards for a series of infrastructure units along critically eroded sections of county coastline. This, in the final analysis, will be achieved by constructing an incrementally re-nourished "sacrificial" dune extension along the length of the entire project area (meaning the dune is allowed to erode during storm events and then reconstructed afterwards). The main idea is that the artificially constructed dune will replace the natural, degraded dune structure and absorb the impact of coastal hazards, thus reducing the amount of damage incurred by coastal infrastructure units, known as "damage elements" (such as roads and houses). The final goal is to reduce the over-all maintenance costs and prevent property damage as much as possible; in other words, to maximize damage-reduction benefits.

4.2. The Army Corps and economic analysis

> It is the Corps of Engineers, after all. Why do economics? Because the Corps is a steward of taxpayer money and must determine which projects are good investments for the nation. Engineering science alone is not enough. The Corps … must follow a path of economic efficiency to reach engineering remedies. (Durden and Fredericks, 2009, p. 1)

Thus begins the first chapter of the Army Corps Economic Primer, one of a series of National Economic Development (NED) Manuals used by the Army Corps for planning guidance. The Army Corps has long been the primary agency responsible for a wide variety of public works throughout the United States, one of the most common being flood prevention in riparian and coastal environments (for example, levies and seawalls). The Army Corps, as a steward of public monies, is also meant to undertake these tasks in a way that maximizes utility. In fact, since the 1936 Flood Control Act, the Army Corps has been legislatively mandated to evaluate projects based on their respective benefit-cost ratios (Arnold, 1988). Given the Army Corps' central role in the design and implementation of coastal management projects, the institutionalized requirement to follow the logic of economic choice means utility maximization ultimately becomes the pivotal factor in deciding between competing possibilities for managing the countries coastal environmental resources.

4.3. The Flagler County hurricane Storm Damage Reduction Project

All Army Corps projects go through a series of five phases in their lifetime: (1) reconnaissance, (2) feasibility, (3) pre-construction engineering and design (PED), (4) construction, and (5) operation, maintenance, repair, replacement and rehabilitation. The Flagler Project completed the feasibility phase in 2014, which to date is the most comprehensive display of the Flagler Project's process and content. The 290 page feasibility study, which combines a CBA of alternative project options with an environmental assessment of the tentatively suggested plan, took 10 years to complete and cost nearly $3.5 M. During the feasibility phase, CBAs were conducted for a variety of alternative action situations, including no action, non-structural measures (flood proofing, relocation, land acquisition, etc.), shore protection with hard structures (seawalls, revetments, groins, etc.), shore protection with soft structures (beach nourishment, geotubes, etc.), combinations of the above, among others. Net benefit calculations and comparisons are prepared for all considered project sections, called "reaches", which collectively make up the entire project area. Some reaches can become automatically disqualified because they lack minimum requirements (e.g. minimum public access). The Flagler Project received federal support and was allocated funding through the U.S. Senate's passing of the "Water Infrastructure Improvements for the Nation Act" on December 11, 2016, giving project proponents renewed optimism that it will come to fruition; complicating factors, however, remain (Flaglerlive, 2016).

The Flagler Project feasibility study involves four reaches within Flagler County, Marineland, Painter's Hill, Beverly Beach and Flagler Beach (Fig. 1). The Flagler Beach study reach was eventually designated as the tentatively selected plan (TSP), the others having been excluded for either lacking sufficient public access and parking (both federal preconditions) or being deemed economically unviable. The TSP is the plan with the highest net benefits, making it what the Army Corps calls the "National Economic Development" (NED) choice, meaning it maximizes increases in the net value of the national output of goods and services (Durden and Fredericks, 2009). The TSP consists of a 10 foot seaward extension of the existing dune which will lengthen the existing berm and entire active profile seaward along 2.6 miles of critically eroded shoreline. Initial construction is projected to involve dredging on average over 300,000 cubic yards of sand from a "borrow site" 7 miles off shore, with periodic re-nourishments expected on average every 11 years (5 in total). Total project costs are projected to be $43.5 M, with cost sharing between federal and local sponsor (i.e. Flagler County) being 55% ($23.8 M) and 45% ($19.6 M), respectively. The TSP has a benefit-cost ratio of 1.76 over its 50 year lifetime, and is projected to collectively provide for a 95.5% reduction in future infrastructure damages, amounting to $852,000 in average annual net benefits (applying a 3.5% discount rate; alternative calculations using a 7% discount rate were also included in the feasibility study) (USACOE,

Fig. 1. General map of the Flagler County coast, range (R) monuments and Army Corps project study reaches (yellow lines). Source: USACOE (2014, p. 1–4). (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

2014, Chapter 6).

So, how did the Army Corps get to the all-important number 1.76 for its TSP? Evaluation of alternatives considered in the Flagler Project feasibility stage was conducted using a desktop economic computer model called Beach-fx (see Gravens et al., 2007), which mixes coastal evolution modelling with economic impact functions to estimate the costs and benefits of alternative project designs (USACOE, n.d.). Model inputs are comprised of four basic elements: Meteorological data and processes (e.g. plausible storms); Coastal morphology change data and processes (e.g. shoreline response); Economic data and processes (e.g. damage elements); Management measures data and processes (e.g. re-nourishment). The model data is "user populated", meaning model users stock its databases with context-relevant information, which supposedly makes the model easily transferable between contexts. When running a given scenario, the Army Corps generally runs the Beach-fx model for 100 iterations over the planned 50 year project lifetime, the results of which it then aggregates and averages.

5. Problems with economic choice in practice: inaccuracy, exclusion and neglect of the question of distribution

5.1. The problem of accuracy in the calculation of costs and benefits: the case of coastal earth systems models

Conducting CBA of an environmental policy or project with temporally dispersed impacts, as in the case of the 50 year life span of the Flagler Project, requires the capacity to make temporal predictions of future system states in order to calculate the total costs and benefits over the expected lifespan of the project or policy under consideration, which when added up and discounted, reveal total *net* benefits. If net benefits are greater than zero then the project or policy passes the CBA test. For multiple alternatives, net benefits can be compared between project or policy options.

Such capacity to "predict" the future is generally assigned to quantitative earth systems models (Oreskes, 2003). There are, however, many reasons why the parts that compose a model could be erroneous, including faults in the setting of model parameters or dissonance between the equations which underpin mathematized model representations and the functioning of real-world systems they are meant to reflect (Oreskes, 2003; Oreskes et al., 1994). It is common practice for modellers to assume "unrealistic" or proxy system characteristics for practical reasons, such as a lack of reliable field measurements or the need to reduce complexity, for example assumptions about frictionless beach surfaces or average values for water volumes and wave heights (Pilkey et al., 1994). This "parameterization" closes the modelled system by setting boundaries on possible system behaviour. However, practically all natural systems are open systems and thus characterized by contingency and emergent outcomes (Bhaskar, 2010). This implies that model predictions will never *completely* represent the systems they seek to model (a point all modellers would concede), which leaves open the inevitable divergence between precise model predictions and actual systems change, and thus between the calculations based on these predications and the actual costs and benefits accrued in practice.

Many examples exist where quantitative model predictions proved erroneous, leading to serious consequences including inaccurate cost projections, environmental damages, and the loss of credibility of those employing the models (Pilkey and Cooper, 2014a; Pilkey and Pilkey-Jarvis, 2007; Steinberg, 2006; Pielke and Conant, 2003; Oreskes, 2003; Sarewitz et al., 2000). When it comes to the Flagler Project example, the employment of coastal evolution models form the foundation on which the CBA is possible, as they predict when and how the coast will change in response to triggers (e.g. storms) and thus whether certain damage elements will be affected or management actions taken. Inaccuracies in the prediction of shoreline response to triggers would inevitably lead to inaccuracies in the quantification and monetization of costs accrued and damages prevented, jeopardizing the reliability of the CBA. The fact that "model output is not the same as a prediction of the future state of the system" (Oreskes and Belitz, 2001, p. 39) becomes very significant in a practical sense when project economists and engineers attempt to make very precise predictions at small scales (e.g. fractions of meters) over long periods of time (e.g. many decades), where the potential for divergence between model results and actual system changes are high. This is certainly the case for the Flagler Project which attempts to predict beach profile changes at the meter scale over a 50 year project lifespan. The Army Corps (USACOE, 2014, p. 6–7) acknowledges the matter this way:

> Based on these [modeling] parameters, the expected renourishment interval is 11 years, defined by the average time between renourishments being triggered over 100 iterations of a 50 year life cycle simulated by Beach-fx. *In reality, this interval could vary depending on the timing of erosion and storm events*. (emphasis added)

A telling example of the potential for serious divergence comes from the recent devastation wrought by Hurricane Matthew in Flagler County in early October 2016. The plausible storm parameter included in Beach-fx simulations, which sets the boundaries on the probability of impact and possible strength of tropical cyclones, in the Flagler Study utilizes historic data on the numbers and strengths of hurricanes which had previously affected the Flagler County area since records began. In this way, the model simulations privilege stasis and assume that no hurricanes outside of these parameters are possible in the future. However, the possibility of an extreme weather event which supersedes historical precedent is always there, and ignoring the possibility can lead to disastrous consequences (Steinberg, 2006). While accounting for such low-probability events is methodologically possible (see e.g. Weitzman, 2009), their exclusion in the Flagler Project relegates such unlikely events to the realm of impossibility. Hurricane Matthew in fact was in many ways unprecedented in both Flagler County's history and more generally in the Atlantic Hurricane record (Klotzbach, 2016). In this sense, the effects of a storm like Hurricane Matthew, which of course was always possible, on the Flagler Project was *literally* unpredictable within what Cooper and Pilkey (2004) call the "expected universe" constructed through model parameterization.

The erosion in Flagler Beach caused by Hurricane Matthew is indicative of what is problematic with the use of models, particularly averaged intervals of renourishment, in CBA calculations. The Flagler Project is built on the assumption that roughly 1.5 feet of erosion per year occurs, but Hurricane Matthew eroded away up to 30 feet of dune in a matter of hours (Fig. 2). This means that, had the Flagler Project been constructed prior to the arrival of Hurricane Matthew, most if not all the renourished dune would likely have been lost in a single storm, potentially increasing the overall costs of the project in the long run. This, incidentally, is precisely what has happened to a number of other renourished beaches around the country after being impacted by severe weather (Pilkey and Pilkey-Jarvis, 2007).

Beyond the potential for divergence between model results and reality, the use of models can often be extremely exclusive in terms of participation, causing problems with transparency and precluding critical public scrutiny of the evaluative process. The specific predictive earth systems models utilized in the Flagler Project as input to the Beach-fx economic model are SBEACH and GenCade,[1] both which have been problematized by coastal scientists as predicated on unreliable representations of coastal processes (Thieler et al., 2000). However, the use of these specific models is not mentioned at all in the main text of the Flagler Project feasibility study. Nor is it, to the best of my knowledge, on any of the public outreach materials provided by the Army Corps to Flagler County citizens. Only the technical Engineering Appendix A included as supplementary materials to the feasibility study mentions the use of these predictive quantitative models, and, while sections in the engineering appendix are devoted to discussing the "calibration" and "verification" of these models (for a criticism of calibration and verification practices, see Oreskes et al., 1994), their limitations are not discussed in the report at all. Instead, the Army Corps tends to emphasize their use of "the best current practicable

[1] The GenCade model is a synthesis of the GENESIS and Cascade shoreline change models.

Fig. 2. A repeat photograph showing SR A1A in Flagler Beach before (left) and after (right) Hurricane Matthew. Author's photos, October 2016.

knowledge on coastal processes" and tout the "predictive capabilities of coastal evolution models" (USACOE, n.d.). The only pointer towards the limitations of these models comes from readers being directed to a series of technical reports for further information (i.e. Larson and Kraus, 1989; Frey et al., 2012) which outline some the major shortcomings of each model. Because most people are not mathematical modellers or coastal engineers, reading and understanding these technical reports requires particular competencies generally beyond that possessed by the average citizen. In the absence of a more concerted effort to raise and discuss the shortcomings associated with the use of predictive models, this kind of exclusion clouds the possibility for critical public evaluation of the means and ends of important public decisions about environmental policies and projects.

5.2. Exclusion of (social and environmental) considerations in project design and evaluation

As previously mentioned, the Army Corps is mandated to follow a path of economic efficiency in project planning and design and therefor the criterion for project selection centres on respective benefit-cost ratios. This leads to situations where social and environmental concerns which may be salient for the local community are downplayed or excluded from consideration (and conflicting values and interests are likewise glossed over) in project design and evaluation. In calculating the benefits of beach nourishment projects, the primary categories to be included involve (Coburn, 2009, p. 9):

- prevention of physical damages and associated land loss; reduction in maintenance costs of existing protection works;
- reduction of emergency costs to residences, businesses, and governmental entities;
- increased recreational usage, and where appropriate, relief of overcrowding for existing recreational usage; and
- changes in maintenance costs associated with navigation projects.

While the primary categories included in calculating the costs of beach nourishment projects involve (Coburn, 2009, p. 9):

- expected costs of construction,
- the present value of periodic maintenance and nourishment costs, and
- any external costs such as environmental costs associated with mitigation.

Of course, other federal objectives exist, such as Environmental Quality, Other Social Effects and Regional Economic Development; however, the specific type of project undertaken by the Army Corps comes with additional constraints on the kind of federal objectives which should take priority. For Hurricane and Storm Damage Reduction Projects (such as the Flagler Project) in particular the primary goal is to maximize National Economic Development. As a result, the possibility of selecting a certain alternative based on other specified criteria is constrained because "the federal objective to maximize net benefits supersedes any project-specific target output which does otherwise" (USACOE, 2014, p. 4–15). The constraints imposed by this requirement are what a Flagler Beach City Commissioner was referring to when she recalled how some project alternatives were excluded from consideration because they "didn't make the magical number that the Army Corps has" (personal communication, Flagler County City Commissioner, 16/01/2014).

The economic considerations prioritized in the Flagler Project are, however, only a subset of the issues prioritized by the citizens of the City of Flagler Beach who will have to live with the local social and environmental consequences of the Flagler Project if/when it is completed. A recent public survey conducted by the author in collaboration with the City of Flagler Beach showed that citizens do indeed consider economic and infrastructure issues as priorities (Fig. 3). 66% of citizens ranked tourism as a medium to high priority and more than 90% considering the protection of A1A as a medium to high priority. However, social and environmental issues received similar, even higher levels of prioritization by local citizens. For example, recreation was considered a high priority by more than 50% of all survey respondents, while beach cleanliness, an environmental quality indicator, was considered a high priority by 95% of the citizens who responded to the survey. Other issues such as sand dune restoration, protection of dune vegetation and protection of wildlife received similarly high priority levels.

The reduction of the factors considered relevant to project design and evaluation has created some frustration among local officials working with the Flagler Project who have tried to emphasize the importance of social and environmental outcomes. One Flagler County Project Engineer who has been working closely with the Flagler Project since its inception expressed her frustration with the process this way:

> sometimes we would try to press the importance of some [issues] and … it just didn't fit into the model you know, so yea we were kind of frustrated in some ways by that. [We told the Army Corps] 'you don't understanding, we can't lose the beach', you

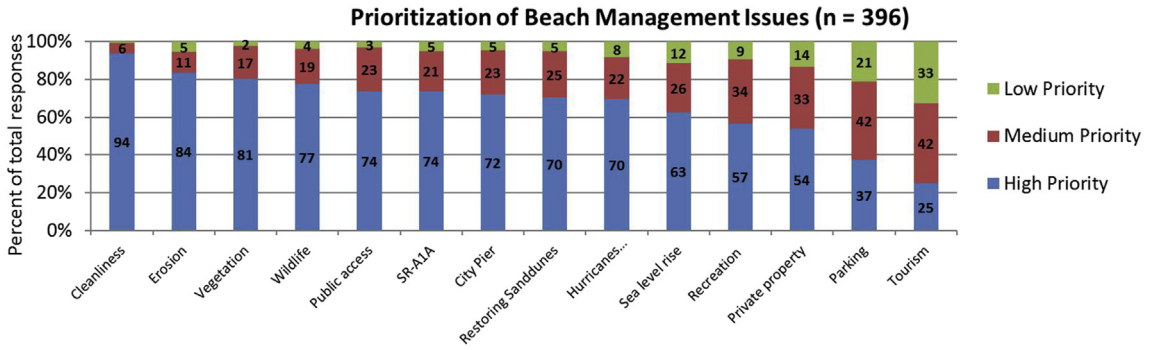

Fig. 3. Citizen prioritization of beach management issues in Flagler Beach. Note that sea level rise was originally "planning for sea level rise" in the survey. Source: author's unpublished data.

> know, that's all we kept telling them. (personal communication, Flagler County Project Engineer, 18/03/2015)

To be fair, beyond prioritizing the maximization of economic benefits, the Army Corps explicitly claims to address other concerns, for example environmental concerns: "In addition to being the NED plan and meeting the Federal objective to contribute to national economic development, the TSP is also consistent with the Environmental Operating Principles because it is a sustainable plan that has taken environmental issues into consideration" (USACOE, 2014, p. 215). However, whether this "consideration" of environmental issues translates into actual environmental protection is far from guaranteed. For example, when it comes to the evaluation of Army Corps project performance, which in some cases is not undertaken at all (Peterson and Bishop, 2005; Pilkey and Dixon, 1996), it generally takes the form of an accounting exercise where the differences between projected and final total costs accrued, damages prevented and sand volumes used are taken as indicators of project success, while other environmental or recreational project effects may be viewed as "incidental" and thus not considered components of the success criteria. In this context, Pilkey (1995; for replies see Hillyer and Stakhiv, 1997; Pilkey, 1997) has demonstrated that strict adherence to CBA and price accounting as the only criteria for project evaluation has allowed the Army Corps to claim near universal success in their beach nourishment activities. However, projects may be deemed "successful" even when community concerns about e.g. environmental quality and recreation have been undermined. If the local beach in the project area washes away between periodically planned nourishments, destroying beach habitat and reducing opportunities for recreation, the damage reduction benefits may still be realized if e.g. the eroded sand sits offshore and continues to reduce wave energy, thus providing damage reduction. Though hoped for social and environmental benefits may be completely lost, the total project costs and sand volume accounting may still proceed as planned, leading to a successful project by accounting standards.

5.3. Aggregation of benefits and disregard for the distribution problem

The Army Corps' TSP in the Flagler Project, as previously mentioned, is also by necessity the NED plan, meaning it is the plan which maximizes "increases in the net value of the *national* output of goods and services" (Durden and Fredericks, 2009, p. 4, emphasis added). Contribution to NED is thus an aggregate indicator of overall social welfare, and therefore does not take into consideration the *distribution* of costs and benefits associated with project implementation and outcomes. In fact, the question of how much Flagler Beach or Flagler County citizens will formally "benefit" from the Flagler Project becomes quite ambiguous upon closer inspection.

Take for instance the distribution of funding costs and damage reduction benefits. Flagler County is the local co-sponsor of the Flagler Project, responsible for covering roughly 45% of the total project costs, with the other 55% coming from federal sources. The county's share will, of course, come from public funds sourced from various tax revenues, such as hotel bed taxes or property taxes. 95% of the benefits in terms of damage reduction provided by the Flagler Project, however, are set to accrue to the Florida Department of Transportation (FDOT) by way of reduced maintenance costs of State Road A1A (Marlowe and Company, 2014). Given that the FDOT has previously spent around $1.5 million annually maintaining erosion control infrastructure along A1A in Flagler Beach (FDOT, 2010), the Flagler Project may amount to a subsidizing of state road expenditures by downloading the costs to county coffers, as the county will be paying substantially more into the project than previously, while the vast majority of the benefits accrue to the FDOT. In other words, Flagler County may be shouldering a substantial portion of the actual costs while perceived benefits are aggregated at the state and national level.

The Army Corps process, however, assumes that distribution of produced benefits matter little to citizens. Take for instance this example of economic logic offered in an Army Corps economic manual:

> You paint your house and can sell it for $3000 more than you could before it was painted. You paint your house and your neighbor can sell his house for $5000 more now that his house is no longer next to a house badly in need of paint. The paint produces $8000 in benefits. How much of those benefits are relevant to you when making the decision to paint or not? Obviously, you are concerned only with the $3000 benefit that accrues to you. It's a matter of perspective. (Durden and Fredericks, 2009, p. 4).

But the use of this logic is in many ways counter to the goal of environmental improvements precisely because environmental improvements are generally *public* goods, not *private* goods, meaning they are "enjoyed in common rather than separately by one consumer only" (Sen, 2001, p. 269).

On the one hand, the aggregate benefits to be realized through the Flagler Project accrue in the form of contributions to NED while local (Flagler County) citizens are made to disproportionately shoulder the financial cost burden. On the other hand, federal support for local erosion control projects rely on the aggregation of locally sourced benefits in the form of e.g. cost reductions through protection of local infrastructure (e.g. State Road A1A), while far away citizens and future generations are meant to shoulder much

of the collective environmental and financial costs of the project. Thus a sort of paradox in distributional considerations in erosion control management is that they can look very different at the local and the national level (Cooper and Mckenna, 2008).

The well-known "Coburn Report" (Coburn, 2009), a congressional oversight and investigation report conducted by the 111th congress of the United States in 2009 and authored by Senator Tom Coburn, explicitly laments the use of federal funds for local erosion control projects, in particular beach nourishment projects, claiming they amount to congress prioritizing "beach pork" (as in pork barrel) over "national needs". Furthermore, some have suggested that the question of whether federal expenditures on coastal protection projects is justified and environmentally sound will only increase in relevance and urgency as sea levels rise and critical erosion continues to spread in Florida and elsewhere (Pilkey and Cooper, 2014b; Haer et al., 2013; Florida Oceans and Coastal Council, 2010).

6. Towards an immanent critique of economic choice

The above reviewed criticisms, as we have seen, have real and important implications in the real-world context of the Flagler Project. The use of earth systems modelling in generating economic input data creates unavoidable uncertainty regarding the accuracy of calculations, raising questions about the validity of the benefit-cost ratios used in the decision making process. The exclusion of environmental priorities held by local citizens which have not been assigned economic value, such as maintenance of sea turtle nesting habitats, vegetation or other qualities, in the evaluative process means that these aspects are likewise omitted from success criteria, leading to a situation where the Flagler Project could be deemed formally successful even if those benefits, such as environmental and recreational improvements, are not provided to citizens in practice. The neglect of the question of distribution brushes over considerable changes in the cost burden assigned, for example with local government taking on a larger financial burden while aggregated project benefits are expected to accrue at the national level (the opposite argument can also be made, i.e. the nation is paying for what amount to local benefits), which raises justified questions regarding the fair allocation of public funds.

However, to be fair, in principle most of these criticisms can be addressed by employing more accurate valuation techniques (for example, better earth systems models or methods of calculating time-series costs and benefits) or by expanding the range of topics which are valued and thus included in CBA calculations (for example, running contingent valuation exercises with citizens to "put a price" on preferences for sea turtle habitat). Furthermore, the latter "problem" of neglecting to consider distribution is not technically a problem from within the logic of economic choice which, by design, "has no interest in – or sensitivity to" the issue of distribution (Sen, 2001, p. 57). The "neglect" of the distribution issue is not a matter of uninformed practitioners, but is central to the utilitarian ethic which underpins economic choice, an ethic which has remained "the dominant ethical theory—and, inter alia, the most influential theory of justice-for much over a century, developed in its modern form by Jeremy Bentham and adopted by influential economists like J.S. Mill, W.S. Jevons and A.C. Pigou" (Sen, 2001, p. 58). In this light, it seems somewhat unreasonable to request that practitioners of economic choice address the distribution issue when the approach itself is explicitly predicated on maximizing *aggregate* utility.

Beyond the potential contained within the economic choice approach to address these concerns, or establishing its right to ignore them, there is a more fundamental problem with the way these criticisms are advanced. In particular, demanding that practitioners of economic choice improve the accuracy of valuation techniques, extend the use of those techniques into previously excluded areas, and that they take account of issues beyond the purview of the strategy itself, despite their critical dispositions, all still perpetuate the same underlying assumption of economic choice, namely that money, via income, provides an adequate basis for assessing contributions to well-being. By implicitly conceding this assumption, such criticisms do not necessitate the *replacement* of economic choice but its *improvement*. Thus, those issues which critics point out have been inaccurately valued or excluded can be incorporated, but still only in terms of their contribution to growth in economic productivity.

However, a more immanent criticism would point to the inadequacy of this underlying assumption that income is an adequate representation of well-being, and thus that growth in GNP is an adequate indicator for development (i.e. increasing well-being). The idea that levels of income or living standards are passable representations of well-being has been problematized by many throughout history. Sen (2001, p. 14) for example quotes Aristotle as saying "wealth is evidently not the good we are seeking; for it is merely useful and for the sake of something else" to illustrate this point. Following this line of argument, Sen points out that while increases in income, particularly for the very poor, can often lead to important improvements in well-being, this is not because income and wealth are desirable in their own right, but because they often substantially expand one's *freedom* to pursue those things in life they have reason to value, which of course includes basics necessities, but also includes other capabilities which give our lives meaning, such as social inclusion, the right to political participation and freedom from all sorts of discrimination.

Building on this recognition of the limitations of judging development in terms of income, Sen then moves to forcefully argue that, rather than evaluating development in terms of a mere *means*, why not measure directly the *end* itself, i.e. the expansion of individual *freedom* to pursue lives people have reason to value (see Sen, 2001, Chapter 1).

6.1. A digression on political choice

Before moving on to social choice as an alternative, I want to make a short (and as such, inevitably somewhat shallow) digression regarding political choice via majority rule and why it can be problematic. The possibility of arriving at a rational, socially-beneficial outcome through a decision making process predicated on individuals acting in terms of their private interest has been criticized by the likes of Rousseau, Marx, Weber and Habermas, among others. Amartya Sen (1995b, p. 10), for example, argues that majority rule can be "a terrible decision procedure" for social evaluation exercises, calling it "not only nasty and brutish, but also short in consistency." Not only does the one-person-one-vote principle of majority rule not guarantee benefits to those who are already disadvantaged (see Sen, 2001, Chapter 1), the influence of factionalism, conflicting interests and other forms of social conflict further undermine the validity of majority rule as an adequate principle for ensuring the public good (see Huntington, 1993). Indeed, much of the scholarly work conducted under the rubric of social choice has been specifically oriented towards addressing the shortcomings of generic majority rule decision making procedures (Sen, 1999). Because of this, I do not deal with political choice directly, but instead move to a social choice procedure which is an improvement on political choice and, as I hope to demonstrate, an improvement on economic choice as well.

6.2. Evaluating development from the perspective of freedom

As Sen has put it, "Seeing development in terms of the substantive freedoms of people … involves the need to assess the requirements of development in terms of removing the unfreedoms from which the members of society may suffer" (Sen, 2001, p. 33), of which insufficient income is only one (though often one very important) component. However, other freedoms, such as participation in community life or political processes, are also critically necessary for people to lead lives they have reason to value. In fact, such freedoms are not only instrumental in facilitating development, but are themselves *constitutive* of the process of development (Sen, 2001, p. 36–41). In this way, development involves the removal of deprivations and un-freedoms, no matter how much income an individual happens to possess. Other research cases in which Sen's approach to development as freedom was applied in the evaluation of environmental management and development conflicts have demonstrated the fruitfulness of the approach in identifying the neglect of important individual freedoms and articulating their consequences for sustainable development practice. For example, Hansen et al. (2015) demonstrate using Sen's approach that even in a context of "strong human rights" the adherence to economic logic in decision making can lead to the neglect of important substantive freedoms which in turn reduces the efficacy of integrated conservation-development projects, even perpetuating further conflict.

Sen (2001, p. 10) considers in particular five distinct but complementary types of freedom: (1) political freedoms, (2) economic facilities, (3) social opportunities, (4) transparency guarantees, and (5) protective security. The relative significance of these freedoms in any given context can be subject to contingency. For example, while the slight average increase of income to an individual (i.e. their economic facilities) who happens to be financially wealthy might have negligible effects on their well-being, the removal of other constraints on freedom, such as those imposed by authoritarian institutions or prejudices, could greatly expand the person's well-being by giving them the capability (e.g. actual social opportunities, protective security or political freedoms) to pursue meaningful things in their life which they may have been prevented from pursuing before and which may or may not have any direct relationship to income.

More concretely, operationalizing development as freedom means paying attention in evaluative processes to the expansion of the *capabilities* individuals have to pursue meaningful lives, where capabilities are understood to be "a kind of freedom: the substantive freedom to achieve different alternative functioning combinations (or, less formally put, the freedom to achieve various lifestyles)" (see Sen, 2001; in particular 74–76). Thus, when viewing development from the perspective of human freedom, aggregate economic indicators are shown to be seriously informationally impoverished and by their own internal logic exclude many important capabilities from consideration. In the context of the Army Corps project, the justification of the nourishment project in terms of its contribution to NED brushes over other important deprivations which are very relevant from the perspective of development as freedom. For example, the exclusion of citizens from the process of selecting criteria to be applied in the evaluative process, which in the Flagler Project were derived solely from Army Corps policy, should be viewed as a deprivation of their freedom to participate in important decisions that affect their lives. While economic choice systematically excludes consideration of capabilities which have no direct bearing on income, viewing development as freedom allows for both those income considerations emphasized by economic choice, as well as a whole range of other capabilities and substantive freedoms, to be incorporated into the evaluative process.

In addition to the incorporation of those social capabilities such as political participation and transparency guarantees, development as freedom has significant implications for the consideration of the environment in decision making processes. Any project that produces reductions in environmental quality, regardless of whether or not it maximizes monetary return on investment, can be viewed, from the perspective of freedom, as amounting to a substantial suppression of the capability of citizens to pursue lives they have reason to value if these lives include enjoyment of the natural environment (in whatever capacity), which, as we have seen, is certainly the case regarding the citizens involved in the Flagler Project. This is not only because environmental quality may affect income levels or living standards, but because people have *other reasons* to value the environment as a component of a meaningful life, such as long walks on the beach, or what have you. This realization is what underpins Sen's celebrated argument for "why we should preserve the spotted owl" (Sen, 2004).

The consideration of the centrality of freedom enhancement for SD can be extended to future generations. Decisions made today should be judged not only in regards to how they affect the substantive freedoms that people possess here and now, but also how those decisions will affect the freedom of future generations (see Scholtes, 2010). For example, destruction of the natural environment, seen from the perspective of freedom, is unsustainable development in the sense that it removes the capability of future generations to enjoy (in whatever capacity) the now destroyed environment, which they may well have had good reasons for keeping around. While individuals today should retain the capability to use the environment in the enhancement of their well-being, the capabilities approach forces those same individuals to consider the impacts of their choices on the capabilities of other, both within and between generations.

From the perspective of development as freedom, those considerations (i.e. the informational basis) which are excluded by the economic choice approach adopted by the Army Corps can be incorporated into the decision making process; by doing so, the evaluation of project goals and outcomes can be conducted with an eye towards the enhancement of real well-being via their contribution to the expansion of the substantive capabilities people possess, rather than solely in terms of the increases in income they may (or may not) receive. With this re-orientation from income to capability expansion as the metric of development, we can re-assess those particular shortcomings of economic choice outlined above, both generally and specific to the Flagler Project, in terms of their impact on human freedom.

6.3. Political freedoms, transparency guarantees and the accuracy of cost-benefit calculations

While this issue could in principle be solved with better techniques (though the modelling technique used by the Army Corps is already very advanced), the perspective of freedom asks who was responsible for selecting the evaluative criteria in the first place—the answer of which of course is the Army Corps professionals, following their agency and legal mandate. From the perspective of freedom, the exclusion of citizens from the process of establishing the relevant criteria used in evaluating the Flagler Project amounts to a deprivation of the political freedoms of citizens, regardless of whether or not project activities are expected to increase income levels. As Sen has remarked, "Even a very rich person who is prevented from speaking freely, or from participating in public debates and decisions, is *deprived* of something that she has reason to value. The process of development, when judged by the enhancement of human freedom, has to include the removal of this person's

deprivation" (Sen, 2001, p. 37). Political participation, while certainly playing an *instrumental* role in development, perhaps even in contributing to economic productivity, is itself a *constitutive* component of the process of development from the perspective of freedom. While public deliberation may not be possible or desirable in every single circumstance (Klauer et al., 2017), its unwarranted exclusion poses serious problems from the perspective of freedom.

Furthermore, the complexity of the techniques (i.e. earth systems and economic models) used to generate benefit-cost ratios in the Flagler Project raises important questions about transparency guarantees, meaning "the freedom to deal with one another under guarantees of disclosure and lucidity" (Sen, 2001, p. 39). If citizens are not openly and fully informed about the assumptions or values which underpin a particular evaluative criteria or selection process, they are precluded from engaging in the kind of unhindered reflection and scrutiny which open public debate demands: This includes transparency regarding the limitations of those already-existing metrics which project developers suggest should be utilized. "If informed scrutiny by the public is central to any such social evaluation", Sen (2001, p. 80) reminds us, "the implicit values have to be made more explicit, rather than being shielded from scrutiny on the spurious ground that they are part of an "already available" metric that the society can immediately use without further ado". In the final analysis, Sen (2001, p. 79) suggests, the question boils down to whether environmental policy decisions should be governed by the logic of *technocracy* (which requires little transparency) or *democracy* (which requires full transparency) (see also Klauer et al., 2017).

6.4. Political freedoms, social opportunities and the exclusion of citizen priorities

As already mentioned, Sen (2001, p. 57) has noted that, from within the economic choice (i.e. utilitarian) approach, the inclusion of various social or environmental considerations in the evaluative process can only be regarding their "indirect" role in well-being, that is, "through their effects on utility numbers". However, from the perspective of development as freedom, people can have a whole slew of reasons why these issues matter other than their contribution to income. Along the lines of Sen (2004) argument for environmental preservation, we should "preserve the spotted owl" not because of its instrumental contribution to increasing income, but because we can come up with a whole range of other reasons for valuing a world populated by spotted owl, and having the political freedoms and social opportunities which give citizens the capability to explain their reasoning and to hear and be heard by others are crucial to the process of development itself. Remembering that 90% of Flagler Beach residents that responded to a public survey said that a healthy beach environment was "Very Important" to their quality of life, considerations of the way environmental degradation might affect people's freedoms to live meaningful lives become crucially important. Boiling the diversity of reasons people have to care about the environment down into monetary metrics does not solve the problem of pluralism, but only evades it.

6.5. Freedom, well-being and the question of distribution

Concern for aggregate benefits is an inherent component of economic choice; however, from the perspective of freedom, "we may be interested in general happiness (or income), and yet want to pay attention not just to "aggregate" magnitudes, but also to extents of inequalities in happiness" (Sen, 2001, p. 62). This is because, while development as freedom is essentially about capability expansion, there are a *wide variety of capabilities* which are not qualitatively equivalent and the relative importance of which are contingent on a variety of factors. For example, the amount of well-being an individual will receive from a given bundle of commodities or level of income depends entirely on a variety of contingent personal and social circumstances (Sen, 2001, p. 70). Thus, while the level of economic facilities obtained by a person can be very important for their individual freedom, a lack of social opportunity or political freedom would reduce the capabilities that individual has to utilize their economic facilities in a way that enhances their well-being; alternatively, individuals may "enjoy" substantial political freedoms and social opportunities, but suffer dearly from a lack of economic facilities which could prevent them from utilizing their other freedoms to the fullest extent (e.g. if one is prevented from attending public meetings because they lack the money to pay for transportation).

This is why, from the perspective of development as freedom, a range and ranking of considerations in collective decision making need to be socially negotiated. That is, so that decisions can be made in regards to not only the expansion of freedom of individuals, but as regards the removal of the most pressing unfreedoms which have been identified according to an agreed upon system of prioritization. We would, for example, likely prioritize the more immediate issue of providing a starving person with the capability to access food before we prioritized a person's capability to enjoy long walks on the beach, though both of these are important capabilities which people have good reasons to value. In practice, exactly which capabilities are selected and how they are ranked in terms of importance can only be determined through a social choice exercise.

7. Towards social choice as a practical alternative

Seeing development as the expansion of capabilities leads to the need for development practitioners, rather than following economic or political choice, to follow a social choice approach to evaluation and decision making. The possibility of social choice, operationalized through "a reasoned consensus on a range of [evaluative] weights" (Sen, 2001, p. 78), rests on three important supporting conditions. These include 1) an appropriate evaluative framework, 2) institutions that work to promote social goals and valuational commitments, and 3) behavioural norms and reasoning that allow us to achieve what we try to achieve (Sen, 2001, p. 249). In outlining the basic characteristics of what I suggest is a promising alternative to the dominance of economic choice, I will individually explain these three conditions, including what their realization implies for decision making procedures in the context of the Flagler Project. Regardless of whether actors involved in the Flagler Project were keen to adopt a direct, supplementary or indirect approach to capabilities considerations (see Sen, 2001, p. 81–85), the general considerations outlined below would remain essential considerations in any case.

7.1. Establishing an appropriate evaluative framework

When considering the production of an appropriate evaluative framework to be utilized in a social choice exercise, Sen (2001, p. 78–79) reminds us that:

> it is crucial to ask, in any evaluative exercise … how the weights are to be selected. This judgmental exercise can be resolved only through reasoned evaluation. For a particular person, who is making his or her own judgments, the selection of weights will require reflection, rather than any interpersonal agreement (or consensus). However, in arriving at an "agreed" range for *social evaluation*, there has to be some kind of a reasoned "consensus"

on weights, or at least on a range of weights. This is a "social choice" exercise, and it requires public discussion and a democratic understanding and acceptance.

The process of forming a concensus on a range of evaluative weights involves open and honest public deliberation among those citizens and practitioners likely to be impacted by the project or policy under consideration. This invovles the expression of individual reasons for individual preferences, of course, but it also invovles the willingness to entertain and potentially be swayed by the reasons presented by others. This, furthermore, requires a commitment to being explicit regarding one's values and reasons, which is essential for any social choice exercise to remain open to scrutiny and criticism (Sen, 2001, p. 30). The goal in such social choice exercises is not necessarily to achieve unanimity or the same ranking of weights in all evaluative exercises. Instead, as Sen (2001, p. 33) has put it, "[g]iven the heterogeneity of distinct components of freedom as well as the need to take note of different persons' diverse freedoms … there will no doubt remain differences in possible overall rankings, but their presence is not embarassing to the purpose at hand".

In the context of the Flagler Project, the formation of an apprioriate evaluative framework would need to involve more active and open deliberation between local citizens, elected officials and Army Corps representatives in order to establish a wider range of weights to be considered in project evaluation beyond the monetary metrics of economic choice, though such metrics will obviously remain as a relevant consideration. The inclusion of such considerations as impacts on environmental quality, opportunities for public participation and distribution of costs and benefits would further enhance the informational basis upon which the Flagler Project would be evaluated and allow more direct emphasis to be placed on non-utility considerations which had been previously neglected.

7.2. Reforming supporting institutions

The establishment and application of an appropriate evaluative framework relies on the existence and support of social institutions. Citizen's in the United States enjoy a wide variety of important political freedoms supported by the countries democratic political institutions. However, limits to public participation are still imposed through rigid decision making structures, legislatively mandated prioritization and hierarchy. The citizens of Flagler Beach have already experienced a deprivation of their capability to participate meaningfully in coastal management decisions through their interactions with other government agencies in the past (Boda, 2015), and the rigid selection criteria which guide Army Corps evaluative processes are no less exclusive. Granted, citizens are provided the opprotunity to voice their opinions to project managers, but the incorproation of these opinions is, like all other considerations, filtered through the pre-adopted economic choice evaluative criteria.

Moving beyond such "token" participation, as Arnstein (1969) might have called it, to institutional arrangements that expand political freedoms and social opportunities requires adjustments in the formal policies which currently constrain Army Corps decision making procedures. This naturally would include the establishment of forums for meaningful public deliberation, but also the need to formalize institutional support for the outcomes of those deliberative processes. This would imply the need for the Army Corps and other public agencies, while still incorporating economic metrics as relevant information, to expand their consideration of relevant information to other social concerns regardless of whether or not they have a direct or indirect impact on economic metrics. Adjusting institutional arrangements to accommodate a wider informational basis, and by extension more meaningful opportunity for public participation in evaluative processes, would not only advance important individual freedoms but also work to improve the effectiveness and adequacy of the institutions themselves. That is, there is a "two-way relationship between (1) social arrangements to expand individual freedoms and (2) the use of individual freedoms not only to improve the respective lives but also to make the social arrangements more appropriate and effective" (Sen, 2001, p. 31).

7.3. Nurturing behavioral norms and reasoning

The social choice approach is in sharp contrast to the economic choice approach, both in its informational basis as well as regarding its underlying assumptions about the human agent. "The basic question that is raised by such a market-oriented approach", argues Sen (1995a, p. 23):

> is whether this view of the individual as an operator in a market best captures the problems of environmental evaluation. An alternative view is to see the individual as a citizen - an agent who judges the alternatives from a social perspective which includes her own well-being but also, quite possibly, many other considerations.

Such a shift in perspective requires, as Sen (2013, p. 8) has put it, that we "see human beings as agents who can think and act, not just as patients who have needs that require catering." The operationalization of Sen's capabilities approach relies on the human capacity for *reason* to come to interpersonal agreements on which evaluative weights are to be considered and how they are to be ranked (Sen, 1995b). Importantly, as Bartkowski and Lienhoop (2018) point out, the kind of "reasoning" which informs the formation of an agreement on weights to be used in a social choice exercise should be thought of in terms "reasonableness" (i.e. intersubjective reasoning) rather than "rationality" (i.e. reasoning with oneself). And while the "heterogeneity of distinct components of freedom as well as the need to take note of different persons' diverse freedoms" will often lead to "arguments that go in contrary directions" (Sen, 2001, p. 31), engaging in these arguments and political debates is itself an important constitutive component of the process of development itself. Because all human beings are endowed with the capacity to reason, the appropriate behavioural norms and reasoning which support social choice are not in need of being *formed*, but *nurtured*. And while we should of course avoid assuming that all citizens and decision makers try constantly to promote some selfless "social good", it is just as important to "escape … the 'low-minded sentimentalism' of assuming that everyone is constantly motivated entirely by personal self-interest" (Sen, 1995b, p. 15).

8. Conclusion

While the typical criticisms levelled against the economic choice approach, such as problems with accuracy in valuation, the exclusion of salient social and environmental considerations, and the neglect of issues of distribution, can have important practical consequences in the context of a particular instance of application, they do not necessarily require the abandonment of economic choice in favor of another, better decision making approach to ensure SD. Only when the underlying assumption of economic choice, namely that income is an adequate indicator of well-being, is shown to be wanting do these criticisms require that a different

choice strategy be adopted to resolve them. In this article I have argued, following the influential work of Amartya Sen, that such an approach should evaluate SD projects and policies not in terms of income, but in light of their contribution to the capabilities people actually have to pursue lives they have reason to value. In practice, moving from economic choice to social choice in coastal management relies on the establishment of an appropriate evaluative framework, supported by appropriate social institutions and facilitated by an acknowledgement and expression of the human capacity for reason and empathy, all of which require adjustment be made to existing institutional structures and public participation practices.

The social choice approach advanced in this article allows for the inclusion of a much broader basis of information in evaluative processes while also linking the evaluation of processes and outcomes directly to the actual freedoms people have to live fulfilling and meaningful lives. However, it is important to emphasize again that the establishment of these basic social choice components does not imply that unanimity in outcomes is guaranteed or inevitable; rather, participation in the public deliberation of disagreements is a constitutive part of the process of development itself. The process can be messy, but this is not to its discredit. Rather, as Sen (2001, p. 79)\ reminds us, no “magical formula” for addressing complex social choice issues exists precisely because the process of weighting is “one of valuation and judgement, and not one of some impersonal technology”.

References

Ackerman, F., Heinzerling, L., 2002. The humbugs of the anti-regulatory movement. Cornell Law Rev. 87, 648.

Anderson, M., Teisl, M., Noblet, C., Klein, S., 2015. The incompatibility of benefit–cost analysis with sustainability science. Sustain. Sci. 10, 33–41.

Arnold, J.L., 1988. The Evolution of the 1936 Flood Control Act. Office of History, US Army Corps of Engineers.

Arnstein, S.R., 1969. A ladder of citizen participation. J. Am. Inst. plan. 35, 216–224.

Bartkowski, B., Lienhoop, N., 2018. Beyond rationality, towards reasonableness: enriching the theoretical foundation of deliberative monetary valuation. Ecol. Econ. 143, 97–104.

Beach Management AD HOC Committee, 2015. City of Flagler Beach Beach Management Plan.

Bhaskar, R., 2010. Contexts of Interdisciplinarity: Interdisciplinarity and Climate Change. Routledge.

Boda, C.S., 2015. Power and rationality in coastal planning: effects on participation and possibility in the management of barrier island dunes in Flagler Beach, Florida, USA. J. Coast. Conserv. 19, 561–576.

Coburn, T., 2009. Washed Out to Sea: How Congress Prioritizes Beach Pork over National Needs. Office of Senator Tom Coburn, MD.

Cooper, J., Mckenna, J., 2008. Social justice in coastal erosion management: the temporal and spatial dimensions. Geoforum 39, 294–306.

Cooper, J., Pilkey, O., 2004. Longshore drift: trapped in an expected universe. J. Sediment. Res. 74, 599–606.

Durden, S.E., Fredericks, J., 2009. Economics Primer. Institute for Water Resources Report. United States Army Corps of Engineers.

Faran, T., 2010. Synthesis of the discourses on development and sustainable development. Globalization Informed by Sustainable Development (GLOBIS). In: European Union Seventh Framework Programme: Theme 6- Rethinking Globalization in the Light of Sustainable Development.

FDOT, 2010. SR A1A PD&E Study Final Project Development Summary Report. Florida Department of Transportation- District 5 and U.S. Department of Transportation Federal Highway Administration.

Flaglerlive, 2016. In: Flagler Beach Again, Sen. Nelson Conveys Feds' Message on Beach Fix: No Seawalls. December 12. FlaglerLive.com.

Florida Department of Environmental Protection, 2016. Critically Eroded Beaches in Florida. Engineering, hydrology and geology program Division of Water Resources Management.

Florida Oceans and Coastal Council, 2010. Climate Change and Sea-level Rise in Florida: an Update of "The Effects of Climate Change on Florida's Ocean and Coastal Resources." [2009 Report]. (Tallahassee, Florida).

Frey, A.E., Connell, K.J., Hanson, H., Larson, M., Thomas, R.C., Munger, S., Zundel, A., 2012. GenCade Version 1 Model Theory and User's Guide. DTIC Document.

Gravens, M.B., Males, R.M., Moser, D.A., 2007. Beach-fx: monte Carlo life-cycle simulation model for estimating shore protection project evolution and cost benefit analyses. Shore Beach 75, 12.

Haer, T., Kalnay, E., Kearney, M., Moll, H., 2013. Relative sea-level rise and the conterminous United States: consequences of potential land inundation in terms of population at risk and GDP loss. Glob. Environ. change 23, 1627–1636.

Hanley, N., Barbier, E.B., Barbier, E., 2009. Pricing Nature: Cost-benefit Analysis and Environmental Policy. Edward Elgar Publishing.

Hansen, M., Faran, T., O'Byrne, D., 2015. The best laid plans: using the capability approach to assess neoliberal conservation in South Africa—the case of the iSimangaliso wetland park. J. Environ. Dev. 24, 395–417.

Heinzerling, L., Ackerman, F., 2002. Pricing the priceless: cost-benefit analysis of environmental protection. Georgetown Environmental Law and Policy Institute: Georgetown University Law Center.

Hillyer, T. M. & Stakhiv, E. Z. 1997. Discussion of: Pilkey, OH, 1996. The fox guarding the hen house (editorial), journal of coastal research, 11(3), iii-v. J. Coast. Res., 259–264.

Hockley, N., 2014. Cost–benefit analysis: a decision-support tool or a venue for contesting ecosystem knowledge? Environ. Plan. C Gov. Policy 32, 283–300.

Huntington, S.P., 1993. The Third Wave: Democratization in the Late Twentieth Century. University of Oklahoma press.

Kates, R.W., 2011. What kind of a science is sustainability science? Proc. Natl. Acad. Sci. 108, 19449–19450.

Kates, R.W., Parris, T.M., Leiserowitz, A.A., 2005. What is sustainable development? Environment 47, 8.

Klauer, B., Bartkowski, B., Manstetten, R., Petersen, T., 2017. Sustainability as a fair bequest: an evaluation challenge. Ecol. Econ. 141, 136–143.

Klotzbach, P., 2016. It's not hype- Hurricane Matthew has been blasting through records. Wash. Post. October 5. https://www.washingtonpost.com/news/capital-weather-gang/wp/2016/10/05/its-not-hype-hurricane-matthew-has-been-blasting-through-records/?utm_term=.74d1270bcd97.

Larson, M., Kraus, N.C., 1989. Sbeach: Numerical Model for Simulating Storm-induced Beach Change. Report 1. Empirical Foundation and Model Development. DTIC Document.

Macintyre, A., 1996. A Short History of Ethics: a History of Moral Philosophy from the Homeric Age to the 20th Century. Touchstone, New York.

Marlowe and Company, 2014. RE: Correspondence between Marlowe & Company Government Affairs Consulants and Flagler Beach City Manager Type to BRUCE CAMPBELL. Monday, June 30.

Oreskes, N., 2003. The role of quantitative models in science naomi Oreskes. Models Ecosyst. Sci. 13.

Oreskes, N., Belitz, K., 2001. Philosophical issues in model assessment. Model valid. Perspect. hydrol. Sci. 23.

Oreskes, N., Shrader-Frechette, K., Belitz, K., 1994. Verification, validation, and confirmation of numerical models in the earth sciences. Science 263, 641–646.

Pearce, D., 1998. Cost benefit analysis and environmental policy. Oxf. Rev. Econ. policy 14, 84–100.

Peterson, C.H., Bishop, M.J., 2005. Assessing the environmental impacts of beach nourishment. Bioscience 55, 887–896.

Pielke Jr., R.A., Conant, R.T., 2003. Best practices in prediction for decision-making: lessons from the atmospheric and earth sciences. Ecology 84, 1351–1358.

Pilkey, O.H., 1995. The fox guarding the hen house. J. Coast. Res. 11.

Pilkey, O. H. 1997. Reply to: Hillyer, TM and Stakhiv, EZ, 1997. Discussing of: Pilkey, OH, 1996. The fox guarding the hen house (editorial). Journal of Coastal Research, 11(3), iii-v. Journal of Coastal Research, 13, 265–267.

Pilkey, O.H., Dixon, K.L., 1996. The Corps and the Shore. Island Press Washington, DC.

Pilkey, O.H., Pilkey-Jarvis, L., 2007. Useless Arithmetic: Why Environmental Scientists Can't Predict the Future. Columbia University Press.

Pilkey, O.H., Young, R.S., Bush, D.M., Thieler, E.R., 1994. Predicting the behavior of beaches: alternatives to models. Proc. Littoral 53–60.

Pilkey, O.H.J., Cooper, A.G., 2014a. The Last Beach. Duke University Press.

Pilkey, O.H., Cooper, J.A.G., 2014b. Are natural beaches facing extinction? J. Coast. Res. 70, 431–436.

Porter, T.M., 1996. Trust in Numbers: the Pursuit of Objectivity in Science and Public Life. Princeton University Press.

Rose-Ackerman, S., 2010. Putting cost-benefit analysis in its place: rethinking regulatory review. U. Miami L. Rev. 65, 335.

Sarewitz, D., Pielke, R.A., Byerly, R., 2000. Prediction: Science, Decision Making, and the Future of Nature. Island Press.

Scholtes, F., 2010. Whose sustainability? Environmental domination and Sen's capability approach. Oxf. Dev. Stud. 38, 289–307.

Scoones, I., 2016. The politics of sustainability and development. Annu. Rev. Environ. Resour. 41.

Sen, A., 1995a. Environmental evaluation and social choice: contingent valuation and the market analogy. Jpn. Econ. Rev. 46, 23–37.

Sen, A., 1995b. Rationality and social choice. Am. Econ. Rev. 85, 1–24.

Sen, A., 1999. The possibility of social choice. Am. Econ. Rev. 349–378.

Sen, A., 2001. Development as Freedom. Oxford Paperbacks.

Sen, A., 2004. In: Why We Should Preserve the Spotted Owl, vol. 26. London review of books.

Sen, A., 2013. The ends and means of sustainability. J. Hum. Dev. Capab. 14, 6–20.

Solomon, R.C., 1985. In the Spirit of Hegel. Oxford University Press.

Solow, R.M., 1974. The Economics of Resources or the Resources of Economics. Classic Papers in Natural Resource Economics. Springer.

Solow, R.M., 1993. An almost practical step towards sustainability. In: Resources Policy: Invited Lecture on the Occasion of the Fortieth Anniversary of Resources for the Future. Resources and Conservation Center, Washington DC, pp. 162–172. September.

Steinberg, T., 2006. Acts of God: the Unnatural History of Natural Disaster in

America. Oxford University Press.
Stern, D.I., 1997. The capital theory approach to sustainability: a critical appraisal. J. Econ. Issues 31 (1), 145–174.
Thieler, E.R., Pilkey Jr., O.H., Young, R.S., Bush, D.M., Chai, F., 2000. The use of mathematical models to predict beach behavior for US coastal engineering: a critical review. J. Coast. Res. 48–70.
USACOE, 2014. Flagler County, Florida Hurricane and Storm Damage Reduction Project- Draft Integrated Feasibility Study and Environmental Assessment. U.S. Army Corps of Engineers, Jacksonville District.
USACOE. n.d. Beach-fx. Available. http://www.erdc.usace.army.mil/Media/FactSheets/FactSheetArticleView/tabid/9254/Article/476718/beach-fx.aspx. (Accessed 26 November 2015).
Weitzman, M.L., 2009. On modeling and interpreting the economics of catastrophic climate change. Rev. Econ. Stat. 91, 1–19.