THE THRESHOLD PROBLEM IN INTERGENERATIONAL JUSTICE

YOGI HALE HENDLIN

It is common practice in intergenerational justice to set fixed thresholds determining what qualifies as justice. Static definitions of how much and what to save for future generations, however, overestimate human epistemological limits and predictive capacity in regard to uncertainty in social- and ecosystems. Long-term predictions cannot account for the inherent range of contingent variables at play, especially according to contemporary theories of punctuated equilibrium. It is argued that policies deliberately testing ecological limits as currently conceived must be excluded from political calculations to minimize current actions from foreclosing future life quality and options. To better reduce harms to present and future generations and support the stability of just institutions (and the stable environments they depend on) as Rawls and others demand, polities can overcompensate resource allocation to environmental sustainability. Focus on reducing environmental harms benefits both current and future generations, reconciling distributive versus intergenerational justice trade-offs.

INTRODUCTION

A problem with planning for future generations is that even with the best intentions for achieving justice, the uncertainty and range of variables involved in future projections foreclose calculating what allotment is enough (Ekeli 2004; Charlesworth and Okereke 2010). This article challenges a fundamental assumption pervasive in the intergenerational justice debate: that current generations can accurately (if not precisely) predict

ETHICS & THE ENVIRONMENT, 19(2) 2014 ISSN: 1085-6633

Direct all correspondence to: Journals Manager, Indiana University Press, Office of Scholarly Publishing
Herman B Wells Library/350, 1320 East 10th Street
Bloomington, IN 47405 USA iuporder@indiana.edu

the acceptable threshold of savings and investments necessary to deliver justice to future generations (e.g., Barry 1999; Cowen 2007; Gosseries 2001, 2008; Langhelle 2000; Meyer and Roser 2009; Padilla 2002; Page 2007; Parfit 1984; Rawls 1971, 1999b, 2003; Vanderheiden 2008; Young 1993). Notwithstanding their widely divergent methodological assumptions and desiderata for substantive outcomes of justice, these theorists are united in aiming to establish minimal and universalizable thresholds designating the quantity and quality of bequeathments necessary to fulfill intergenerational justice, based on the idea that such determinations are in the first place possible.

The following is a meta-critique of threshold theories of intergenerational justice, based on the claim that temporally-universalizing minimum thresholds of justice inescapably provides insufficient mechanisms to buffer against error, accident, or surprise as situations unexpectedly or nonlinearly change. Selecting fixed justice criteria rather than providing avenues for updating the conditions of justice as generational needs and opportunities evolve, propagates unintended, undesirable, and unjust consequences for future generations. Ironically, the very inclination driving intergenerational justice theorists to outline *universal* criteria, viz., to ensure justice is delivered, underwrites foreseeable manifest intergenerational *injustices*. Insofar as threshold theories seek to establish *minimum* acceptable levels of intergenerational justice (whatever the currency of justice is designated to be), implicit is a zero-sum tug-of-war between maximizing current use of resources (often coupled with the worthy aim of fulfilling present distributive justice) versus realizing duties to future generations. Such delicately poised threshold conceptions of intergenerational justice weighted towards maximizing current permissible consumption entail that if any number of unexpected events transpire, minimally sufficient savings for future generations quickly become insufficient.

I argue that threshold theorists' approaches to intergenerational justice lack epistemological soundness and are apt to fail to produce practical nonideal outcomes if implemented, as no principle of intergenerational distributive justice can correctly account in advance for environmental or social uncertainties that alter the resources polities possess to bequeath. Disciplinary preoccupation with composing and tweaking the most just bequeath package balancing the interests of the current generation with duties to future generations has eclipsed the more fundamental question of defining the first steps to support and safeguard quality of life across

generations, including our own. In the effort to devise universalizable principles that hold across time (e.g. Rawls 1971, 255; 2005, 274), threshold theories of intergenerational justice fail to take into account:

1. Changing contingencies in social and ecosystemic conditions (e.g., Thompson 2009, Ekeli 2004);
2. The significance and consequences of multi-stable system states (punctuated equilibrium) and how once degraded beyond a certain point of resiliency ecologies can "tip" into other equally stable but drastically different states (such as portions of the Amazon rainforest currently re-stabilizing to savanna and seasonal forest) (Gunderson and Holling 2002, van der Sluijs and Turkenburg 2006, Norton 1999);
3. Epistemological constraints inherent in future-oriented thinking and planning (Charlesworth and Okereke 2010, Boersema 2001, Bostrom 2013).

Taking seriously not only ecological limits, but also unavoidable epistemological limits, requires a different approach to the question of intergenerational justice than the commonly accepted practice of configuring binary just/unjust thresholds.[1]

Accepting Rawls' assertion that intergenerational justice requires we bequeath just institutions and that maintaining institutional stability is key for upholding basic liberties (1971), the first section explores various intergenerational justice theories and clarifies how, despite their differences, each depends on affirming a threshold of justice. The second section unpacks the ecological and epistemological assumptions present in threshold theories of intergenerational justice and provides arguments based on complex systems theory for why such suppositions are unsound. Finally, I explore the alternative possibility of iteratively reducing current harms as opposed to the threshold approach of aiming for temporally-fixed universalized goals, and discuss the theoretical and practical advantages of understanding intergenerational justice as more contingent than constant, and more a question of degree than of kind.

1. THRESHOLD LIMITS IN THEORIES OF INTERGENERATIONAL JUSTICE

While threshold theories of intergenerational justice bear relation to ecological thresholds, the connection is indirect. With *threshold theories* in intergenerational justice, I refer to theories establishing universalizable principles that persist over time providing unalterable rules in determining what counts as just or unjust. In contrast, *thresholds in systems theory* and by extension ecology, refer to the amount and kind of perturbations ecosystems and social systems can withstand (their *resilience*) before they change state into an alternate homeostasis.[2]

Leading theories of intergenerational justice accept a zero-sum trade-off between distributive (intragenerational) justice and intergenerational justice (e.g., Cowen and Parfit 1992). If we devote too many resources to saving for the future and not enough to spending and development, the argument goes, we will have short-changed the current generation's worst-off population, causing injustice by saving too many resources that could have gone to economic development, technological innovation and increased fair distribution (Beckerman and Pasek 2001; Lomborg 1998). In devoting a significant percentage of resources toward ecological sustainability, a polity precludes these resources from other uses, which likely harms the worst-off, as well as the general welfare of the population. Beckerman and Pasek, for example, frame intergenerational provisions as "contrived cuts in current levels of economic activity" that "impose sacrifices on the billions of people in dire poverty today" (2001, 65). Lomborg (1998) further suggests natural resource conversion for technological and other development will actually lead to better welfare for future generation (also see Solow (1993) on this point). This perceived trade-off—though not embraced by all intergenerational justice theorists (e.g., Norton 1992)—has supplied reasons for generally minimizing rather than maximizing what we owe to future generations, based on the claim that "no generation can be morally required to make more than certain kinds of sacrifice for the sake of future generations" (Cowen and Parfit 1992, 149; also see Rawls 1971).

In keeping with this trade-off, intergenerational justice becomes a constraint on current consumption and distributive justice, viewed as a necessary but unwelcome duty. This focus on minimizing what constitutes just allocations for future generations is further exacerbated perhaps by our current crisis in motivations for intergenerational justice, since the

understanding of our life and identity as an "intergenerational project" weakens as polities become more heterogeneous and traditional understandings of self-identity and community become more individualistic and atomized in the multicultural liberal state (de-Shalit, Rawls 1971, Dobson 1998, Norton 2005, Habermas 1996).

Previous to the contemporary global environmental crisis confronting the limits to growth,[3] virtually every advance benefitting current generations was simultaneously supposed to benefit future generations (e.g., Beckerman and Pasek 2001). Technological and societal advance plus stability comprised polities' major concerns in terms of being good ancestors to future generations. However, the environmental crisis and the environmental harms we encounter (such as pollution, species extinctions, ecosystem degradation and climate change), has fundamentally altered the content and meaning of intergenerational justice. Acknowledging these backstory suppositions constraining intergenerational justice facilitates evaluating why theorists consistently aim for minimum rather than more charitable definitions of intergenerational justice.

1.1 Institutional and hence Ecosystem Stability as Justice Requirements for Rawls

The just polity[4] must be a stable one; this statement is virtually an axiom of contemporary political philosophy (e.g., Barry 1995, Rawls 2005, Sandel 1982). Enduring institutional stability figures centrally to any Rawlsian or liberal concept of intergenerational justice, and should be understood as a necessary consideration for parsing intergenerational theories. Rawls devotes consequential attention to the need for stability in functioning political institutions, writing that stability "for the right reasons"—non-coercive, non-instrumental reasons—is a test theories of intergenerational justice must pass (2005, xxxvii).

"The basic structure of the well-ordered societ[y]" is "practically stable" if after external perturbations it can "restore these equilibria" of society instead of such events "lead[ing] to even greater changes" in the socio-political structure (Rawls 2005, 401). Rawls adopts what can be termed *resiliency* as the measure of the stable polity (see Gunderson and Holling 2002).

Environmental stability is a necessary but not sufficient factor in maintaining political stability. Rawls illustrates this point when he remarks that after a society has developed institutions that preserve basic

liberties, the Just Savings Principle requires "maintaining just institutions and preserving their material base" (1971, 255). The material base for just institutions includes a concept of ecological sustainability, and Rawls maintains that in this second phase of maintaining just institutions, "nonrenewable resources [must be] carefully husbanded for future use" (2005, 107). Rawls likewise proscribes "striking cases of public harms, as when industries sully and erode the natural environment" (1971, 237). While Rawls does not include natural capital in his list of primary goods, as Dobson suggests he should given the "preconditional characteristics" of environmental stability (1998, 126), Rawls does see stewardship of natural resources (as well as population control) as an "important" element in governance whether just institutions have yet been set up or not (1999b, 38).

It is a main claim of this article that institutional resiliency in many ways is predicated on ecological resiliency. Implicit in all arguments for intergenerational justice are both a desire for stability, and the presumption of its possibility.[5] I investigate the presumption that stable institutions are achievable, asking what a minimal principle of stability requires from theories of intergenerational justice. Just institutions according to Rawls (2005) entail (1) just distribution across generations, (2) just savings to enable such distribution, (3) institutional and hence ecological resiliency, (4) self-sufficiency such that harms are not externalized, and (5) securing basic material needs in order for citizens to enjoy political liberties. While there are many interlocking dimensions to institutional stability (i.e., the maintenance of just institutions requires continued legitimacy, enough resources, an active citizenry), here I chart principally the relationship between ecological stability and institutional stability.[6]

Every theory of intergenerational justice will have to take into account how to maintain the stability of just institutions. Yet, if we take seriously the dependency of stable institutions on their "material base" rooted in resilient ecologies, then a sincere theory of intergenerational justice will have to also elaborate a meaningful schema for maintaining a sustainable ecology. Theorists of intergenerational justice ignoring the dependence of institutional stability on ecological stability do so at the risk of providing piecemeal or inadequate ethical analysis.

1.2 Threshold Theories of Intergenerational Justice: Examples and Definition

Axel Gosseries neatly sums up the current state of intergenerational justice theory: virtually "all theories converge on the principle: 'we should transfer to the next generation at least as much as we inherited from the previous one'" (2008, 447). While he then qualifies this statement, pointing out that utilitarians generally require that current generations transfer more goods to future generations, whereas egalitarians defend the interest of the worst-off currently living in demanding that no generation sacrifice inordinately for the sake of future generations, this generalization is not without cause (Gosseries 2008 447–8). Although the content and precise level of savings for future generations recommended varies between authors, the following broad formula remains relevant: if x conditions are provided for, then justice is met.[7]

This equation can be thought of as the minimum acceptable threshold of intergenerational justice. Each threshold theory can be mapped onto this equation, communicating that in the established debates theorists contest the content rather than the method of identifying what qualifies as intergenerational justice.

Rawls invokes a Kantian categorical imperative for intergenerational justice by extending the veil of ignorance in the original position[8] temporally in both directions. He writes in *A Theory of Justice*, "The [intergenerational] principle adopted must be such that they [the policy-makers of the current generation] wish all earlier generations to have followed it" (1971, 255). Rawls' requirement for any theory of intergenerational justice—even if it flexibly allows for more savings in times of prosperity, and less in times of need—is that the principle be universal across all generations. No matter the contingencies and unanticipated events that may arise, *all* generations must abide by the same principle.

Wissenburg (1999) understands Rawls' position as a middle ground between *weak sustainability* theorists that claim substituting technology and other forms of capital for natural capital poses no problem so long as these substitutions really do meet all the needs of future people (e.g., Solow 1993, Lomborg 1998) and *strong sustainability* theorists who mount arguments that substitutions for natural capital will never adequately suffice and therefore should not be permitted as they carry irretrievable costs (e.g., Norton 1999, 2002, 2005; Ott 2009). Wissenburg develops Rawls's

Just Saving Principle to read: "no goods shall be destroyed unless unavoidable and unless they are replaced by perfectly identical goods; if that is physically impossible, they should be replaced by equivalent goods resembling the original as closely as possible; and if that is also impossible, a proper compensation should be provided" (1999, 193). The crux of these claims—whether or not these replacements can in fact really replace the spent (ecological) capital, or whether or not full compensation can be made—determines whether justice is carried out.

Both strong and weak sustainability theorists mostly define intergenerational justice *relative* to the current generation rather than in *absolute* standards, like capacities theorists such as Nussbaum (2006) and Sen (2009) do (see Ott 2004 for this distinction).[9] Both strong and weak sustainability theorists acknowledge the current generation to be the baseline for what ought to be perpetuated. The strong sustainability versus weak sustainability debate doesn't disagree over ethical requirements that we pass *something* (and a specific amount of that something) on to future generations. The point of contention turns on the fungibility of specific goods, e.g., whether we can justly bequeath more technology and fewer trees. Solow's (1993) defense of weak sustainability, for instance, agrees that we owe future generations opportunities similar to our own, but because he understands resources to be fungible, this threshold is fulfilled not through preserving any particular good or service, but rather through maintaining a stable and constant level of aggregate capital. Again, despite qualitatively different ideas about what should be saved, agreement endures that a minimal sufficient *level* of savings is necessary for intergenerational justice.

While Gosseries does not explicate the specific content of intergenerational bequeathments, thereby endorsing to some degree the substitutability of capital (weak sustainability), he supports a notion of justice based on the reciprocal threshold of that which we received. According to Gosseries' own threshold theory of "indirect reciprocity," because previous generations transferred goods and culture and left enough environmental resources to the current generation, the current generation "owes at least as much" benefit to the subsequent generation as it received from the preceding generation (2009, 123). Like Rawls, this can be seen as a retrospectively-based theory, determining justice to the future based on what the current generation received from previous generations.

Understanding the minimum threshold approach as indispensible to

conceptualize intergenerational justice, Page argues that "any comprehensive account of our duties to others, wherever and whenever they live, must give a convincing answer to… *who* (scope) should get *how much* (pattern) of *what conception of well-being* (currency)" (2007, 2, emphasis in original). Perhaps the epitome of threshold theories in its explicit hypostatizing of universal principles, Page's model of "claims and responsibilities" applies to all people in all generations (2007a, 454).

Strong sustainability measures dismiss substitution of ecological goods for other goods, and Padilla (2002) concurs with Barry (1999) that monetary compensation for losses of nature does not constitute full justice. Padilla argues that monetary substitution as an economic tool for adjudicating disparate goods amounts to "intuition or faith… It does not seem feasible to substitute some essential services like those provided by the ozone layer or the carbon cycle" (2002, 74). The idea that such ecosystem services and processes are not fungible in the unqualified sense of substitutability leads Padilla to conclude that intergenerational equity requires not overstepping "critical levels of some goods, and thresholds that, if surpassed, may cause important [irreversible] alterations" (Ibid.). The threshold of strong sustainability offered by Padilla requires that institutions "recognize and protect [future generations'] right to enjoy at least the same capacity of economic and ecological resources that present generations enjoy" (2002, 81). Barry defines this negatively: while it is "nice" to better the welfare of future generations, he proposes his threshold for justice to future generations as "not making them worse off, which *is* required by justice" (1978, 243–4, italics in original).

As it stands, strong sustainability thresholds are incommensurate with current socio-politics; in addition, they assume (the possibility of) knowledge accurately indicating ecosystemic thresholds from which we must restrain to avert major irreversible ecological shifts. Young's proposal is case in point: "Economic development is consistent with intergenerational equity if and only if opportunities to use, enjoy and consume natural capital are conserved and we do not increase the risk of irreversibly changing essential ecological functions and processes" (1993, 8). This high threshold of justice (avoiding irreversible harms) is also found in Brown Weiss's claim that every generation should be able to "inherit the common patrimony of the planet in as good a condition as it has been for any previous generation and to have as good access to it as previous generations" (1989, 24). Maintaining stable and consistent ecological "pat-

rimony" between generations seems directly at odds with other measures of welfare that require economic or technological advance. The question becomes, which threshold—economic, technological or ecological—does sustaining just human welfare require?

Parfit chooses the variable (and variably interpretable) threshold of a "life worth living" (1984, 388). A life "uniformly of poor quality," for example, in a world with many people but just barely enough resources to stay alive, would fall below this threshold (Ibid.). Previous generations responsible for creating circumstances of people not valuing their lives—should this have been possible to predict (in Parfit's view)[10]—can then be held morally accountable for precipitating unjust outcomes for future generations (1984, 482).

The chief difference between the main intergenerational justice models—indirect reciprocity, the various strands of egalitarian principles, libertarian, utilitarian, and sufficientarian (see Gosseries 2008b)—lies in how "high" or "low" the threshold is placed on our duties to pass something on to future generations, and in "what" is bequeathed. All theories nonetheless take for granted the original stakes Rawls (1971) set out in renewing this debate: that there exists a certain level of savings, above which we owe nothing more and justice is done, below which we are held accountable for inflicting injustice to future generations.

1.3 MINIMUM THRESHOLDS AND FEASIBILITY

Given this brief overview, it becomes apparent that the threshold approach over-confidently asserts boundary conditions (if x, then justice, if below x, injustice) that assume no unforeseen obstacles will hinder actualizing such future states of welfare, as long as the correct level of welfare is aimed for. Aiming for a minimum level of justice does not ensure fulfillment. In fact, by aiming for a minimum level, rather than, for instance, a higher level of intergenerational justice that supersedes the minimum, we compose justice such that all future circumstances must perfectly line up with our theory for justice to obtain. Insofar as theories of intergenerational justice are predicated on ensuring specific amounts of transfers to future generations, they must have some concept of the *feasibility* of such transfers. If theorists believe it impossible to transfer to the next generation roughly as much and similarly useful goods (for weak sustainability theorists), they would not be engaging with concepts of justice other than

as a merely formal exercise. Yet, judging from the available information, intergenerational justice theorists *do* actually believe that the transfers they present are feasible (if requiring major policy change); and debate is active precisely because real futures are at stake in the application of various concepts of what intergenerational justice means. Problems of justice pertaining to ethics may be treated distinctly, as the relationship between theory and practice (or the possibility of practice) exists in ethics in a special way compared to other fields of philosophy.[11]

Minimally just bequeathments do not exhaust our potential bequeathments to future generations. If in fact achieving intergenerational justice is the aim in establishing these minimal thresholds, we must examine whether such formulae on their own can plausibly achieve the justice these theories assert they can. Through examining threshold theories of intergenerational justice against systems theory, epistemological limits, and future uncertainties, the next section explores the feasibility of these claims.

2. WHY THRESHOLD THEORIES ARE UNSOUND

Threshold theories of intergenerational justice fail to "incorporate the complexity of intergenerational problems" into their analysis at a costly premium of presenting theories that in all likelihood, could not and will not provide justice in a world including actual complexities (Padilla 2002, 81). Taking into consideration findings from environmental science and complex systems analysis can help identify what is necessary to develop more robust theories of intergenerational justice.

Commencing analysis of threshold theories with Rawls' configuration that as long as we save a specific minimal amount for future generations we have fulfilled our intergenerational duties, I propose that the sufficientarian notion Rawls and others after him developed (Rawls 1971, Page 2007, see Casal 2007 for an overview) overlooks the probability of likely deviations from optimistic progress in ecological, societal, and technological trajectories. This analysis includes even threshold theories that appear prima facie not to be sufficientarian, as their proposals nonetheless take a sufficientarian structure by positing only savings sufficient for business-as-usual futures, making no provision for less optimistic future scenarios that would render minimal savings insufficient.

Perhaps this unrealistic assumption of the just rate of savings in a

vacuum equaling the just rate of savings in a dynamic world is adopted because most prevailing theories of intergenerational justice do not take into account concepts such as accidents, unexpected contingencies, drastically changed circumstances or severely altered or degraded ecological states. Failure to seriously consider and include in theoretical analysis the destabilizing impact of severely and irreparably degraded ecosystems on human quality of life and the stability of institutions undermines the plausibility of future-oriented ethical arguments. Inquiry into the changing ecological conditions, epistemological limits of human understanding, and punctuated equilibria in ecological systems, informs us that such elements must be included in nonideal theories of intergenerational justice.

The function and limits of temporal universalism applied in fixing permanent standards of savings to future events is best illustrated in Rawls' Kantian reprisal in *Political Liberalism*:

> [T]he parties can be required to agree to a savings principle subject to the further condition that they must want all previous generations to have followed it. Thus the correct principle is that which the members of any generation (and so all generations) would adopt as the one their generation is to follow and as the principle they would want preceding generations to have followed (and later generations to follow), no matter how far back (or forward) in time. (Rawls 2005, 274)

Despite its idiosyncratic flexibility amongst threshold theories in allowing different rates of savings for different generations, Rawls' principle remains restricted to the present generation for its reference point in imagining all possible situations of savings. The theory neglects to modulate for unique conditions different from those in the past, conditions inconceivable from the present vantage point, and as a result of this error yields principles, which if continued indefinitely, could produce very unjust outcomes. Whether conceptions of justice compare the past or the future in extrapolating current standards, as long as one subscribes to a principle that all generations (future or past) should (or must) follow based on presumed steady states and patterns that have not always obtained nor will likely continue in the future, this establishes a static threshold defining what sort of conduct is to be regarded as justice.[12]

The following thought experiment exposes why binding universalizing thresholds of intergenerational justice such as the theorists' discussed above fail to actually provide justice: A present generation (generation 2) may be quite happy to have inherited certain technological innovations

and increased economic standard of living from a previous generation (1), even if this came at the cost of some reduced ecosystemic biocapacity. And this same generation (2) may wish to bequeath to the next generation (3) a comparable mix of technological and economic advancement with further reduced biocapacity. But before long, a generation (4) will not be able to enjoy the fruits of the previous generation's decision to convert natural resources to technological resources because they have ceased to benefit from such a trade-off. The technological and economic capital may have lost its reference point as desirable goods as the ecological context in which they were situated becomes such that predictable ecosystem goods such as climate patterns became destabilized. If generation 4 continues to follow the same principle of bequeathment, they may provide generation 5 with such inadequate ecological capital that generation 5 will no longer be able to bequeath similar or improved technological or economic capital, as other types of capital possess insufficient resources to renew these other types of capital. Generation 4, not constrained to such universalizing Kantian principles, will most likely instead bequeath the next generation (5) a mix of less new technological innovation for the sake of bequeathing what natural resources they inherited rather than further converting natural capital to technological or economic capital. But by then, it may well be that the environment, degraded past its resiliency point, has flipped to a different steady state (see below) that does not produce in the same way or velocity the goods and services humans have come to rely on. As this example relates, a static conception of what intergenerational justice requires is implausible for generations that experience different conditions.

While Rawls' two-stage principle of Just Savings is more flexible than other theories mentioned here, following Rawls' version of Kantian intergenerational justice does not achieve intergenerational justice for the far future, and can instead be seen as a parochial theory matching only the conditions of a specific time in history.[13] Without updateability, each articulation of the intergenerational principle reflects the temporal situatedness of the theory-maker.

2.1. Theoretical and Practical Concerns of Threshold Theories

Justice between generations does not necessarily require bequeathing the same goods and conditions from one generation to the next, nor is this necessarily possible (Beckerman 1997). Situations change between

generations such that bequeathing certain goods perpetually may produce irrational and unintended consequences. Thresholds are inadequate in forecasting what constitutes intergenerational justice according to temporal fixation of one set of values and possibilities on future conditions that will be invariably different and likely (in the far future) drastically different. While there is good reason to believe that humans will always have various (bodily) basic needs (Ekeli 2004), what we value and cultural needs are apt to fluctuate with time (Thomson 2009). Linearly projecting future capacities to achieve x, assuming continuous development or progression of current social and ecological states, omits any sort of systems-theoretical analysis. In a closed system such as the Earth, precluding iterative updates to definitions of justice as future circumstances change, mistakenly ascribes either impossible to achieve or undesirable conditions for what comprises justice.

Both Gosseries' and Hiskes' theories presuppose a growing or at least constant basket of total goods to pass on to future generations. These theories' baselines for acceptable human welfare implicitly accept the transferability or fungibility of one type of capital to functionally stand in for other types of capital (see Norton 2002). Furthermore, certain types of capital such as technology, are still materially tied to actual ecological goods that facilitate them. While there has been movement to "dematerialize" and "decouple" economic activity from ecological exploitation, so that economic growth could coincide with environmental sustainability (Mol 2003), this has not yet proven very successful (Foster 2012). As other forms of capital are in the final analysis not completely independent from the state of ecological materiality, human wellbeing is also inexorably tied to not undermining the environmental basis of life and life processes through destabilization. Meeting prescribed thresholds becomes increasingly unlikely should ecological capital actually be non-substitutable for other goods, and decline rather than increase.

The problem of attending to intergenerational justice on a planet with thermodynamic limits to growth (Farrell 2009) is seen in the paradox presented by Cowen's potentially conflicting conclusions. He insists that "[o]ur strongest obligation is to adopt growth-maximizing institutions," while at the same time asserting, "We should care most about those environmental problems that will impact the long-run rate of true GDP growth" (2007, 40). While combining maximizing growth without undermining the preconditions for growth is a common desiderata for Maxi-

mum Sustainable Yield (MSY) theory (Williams 1978), Cowen presents us with an aporia. The longevity of a purely growth-maximizing society may be very short, burning through nonrenewable resources quickly and then left in a lurch (Bostrom 2013); conversely, comprehensively attending to environmental problems may cause short-term negative economic growth impacts even as it enables (potentially) longer-term sustained positive growth. If adopting "growth-maximizing institutions" is to denote long-term growth-maximizing according to MSY, then this assumes we know what the optimal maximum amount of exploitation of resources is, such that we can sustainably harvest resources without reducing our overall stock of renewable resources. Such exact knowledge is unfortunately not available to us, and thus it has presented many problems in MSY implementation (Larkin 1977, Williams 1978).[14] As we currently are already extracting and using up renewable resources well above the replenishment rate, then growth maximization in the short-term will be pitted against growth maximization in the long-term.

Thus, we come to the crux of the intergenerational justice problem: providing enough for current generations such that the level of sacrifice is not too high, while not loading future generations with unjust costs for our present consumption (Ekeli 2004; Tremmel 2006). How do threshold theories measure up? Given the above analysis, threshold theories of intergenerational justice encourage pushing the MSY line, overlooking problems of precaution, as well as epistemological and systems-theoretical concerns. They assume that the status quo will continue *ad infinitum* (Charlsworth and Okereke 2010).

2.2 The Limits of Substitutability

Weak versus strong sustainability turns on the question of substituting natural capital for other types of capital, and as Dobson indicates, "substitutability is part of the language in which our concern for future generations is expressed…'justice to future generations' will never map exactly onto 'protection of nature'" (Dobson 1998, 260–61). Substitutability as a program can be problematic, but as a practice is inevitable. While banking on substitutability produces the devaluation of nature, people, cultures, and traditions, the idea that we can bequeath to future generations exactly what we have received from our predecessors (or the same mix of goods) is implausible. We can accept that some substitution will occur anyhow without deliberately planning on reducing crucial

building blocks of human existence, such as functioning ecosystems, because we believe that bequeathing more of other goods will compensate for these losses. The logic of substitutability and compensation always only works through reducing phenomena and goods to a common currency, as we do when we designate goods as "capital," that can be traded and exchanged through the medium of interchangeability, in the case of capital, money. While detailed critiques questioning the appropriateness of applying individual welfare economics to nonfungible goods can be found elsewhere (Norton 1999, 2005), let it suffice that there are limits to substitutions.[15] While there may be functional equivalences for individual goods, there is no functional equivalence for ecosystemic services (Gunderson and Holling 2002; Padilla 2002).

Between the hypotheses that substitution produces harms or not, "[f]acing a false-negative result, we 'only' put more effort in nature conservation practices than would actually be [minimally] necessary, whereas a false–positive result brings future shortages in natural capital and crisis" (Schultz et al 2008, 475). While such a claim may have been groundless before the Anthropocene, our era when human activity is the prime ecological driver, now too much restraint from engaging in maladaptive environmental behavior does not seem to be humanity's major problem.

2.3 Adopting Epistemological Humility

Indeterminacy works in both directions. Future people could have many more resources and technological innovations that repair harms done, and the environment could also be more resilient than contemporary scientists believe. However, a reliance on technology or luck to ameliorate harms the present generation causes may be merely a cop-out and unjust assumption. In the same way as we cannot with certainty claim that the temperature will rise by a particular amount by 2050, we cannot rely on technology-as-panacea to solve future problems knowledgably created today. That certain patterns of technological advance have been observed in the past (e.g., Moore's Law that the computer transistor density doubles roughly every 18 months) is no indication that they will necessarily hold for the future, and the different facets of the problem of induction David Hume and Karl Popper identified (Taleb 2007), pose significant challenges to conventional threshold theories of intergenerational justice.

The problem of induction rests on the idea that past events form

coherent patterns that produce universal rules that can then be used to predict future occurrences. But future occurrences—especially pertaining to complex systems and feedbacks between destabilized ecosystems and social systemic behavior—are fundamentally indeterminate, and even the best scientific or theoretical models can quickly be overturned within a few years.

An example of such swift but sweeping changes in scientific opinion can be seen in the drastic upswing in temperature increases in climate change predictions. In 2007 the IPCC anticipated a 1.5–4.5°C increase in surface temperature by 2100 due to climate change (2007); by 2010 the US National Academy of Sciences predicted a 1.1–6.4°C increase by 2100 above the 1°C increase that has already occurred in the past hundred years (National Research Council 2010); in 2012 a World Bank-commissioned report dedicated to averting our current carbon trajectory warns against the extreme consequences of a mean 4°C temperature increase by 2100 (World Bank 2012). Without betting on which model is the "correct" one, the volatility of scientific prediction—especially future-oriented determinates revising likely scenarios to reflect higher and higher mean global temperatures—suggests that in postnormal situations where the stakes are high and the scientific predictive capacity for future situations is uncertain, that precaution is necessary (Van Sluijs 2012; Arcuri 2007). Policies that aim at containing global mean temperatures within a 2°C increase over pre-industrial levels commit the same categorical mistake of overconfidence that intergenerational justice theorists do when they balance thresholds of human welfare on the precarious brink of minimum levels of savings. Yet, the protective policy element of precaution rarely has found its counterpart in theories of intergenerational justice.

Charlesworth and Okereke (2010) neatly sum up the main points of epistemological overconfidence that render threshold approaches dangerous and reckless:

> The assumptions about knowledge of the Earth System appear to be (1) we need more knowledge so that we can know just how far we can push the climate (Earth) system. (2) Humans can know what level of stress we can cause to the Earth System before the climate (Earth) system changes state. (3) 'Experts' can tell us this. (4) All tipping points will be imagined and identified. (*5*) Levels of stress before tipping points are reached can be identified and 'measured' robustly

> enough and soon enough to allow avoidance of tipping points in the Earth System despite significant inertia. (121–22)

This recognizes the limited application of science *qua* instrument of control to policy-making for such postnormal topics—topics such as sustainability and intergenerational justice *a fortiori* do not permit of perfect knowledge because of the inherent uncertainty as well as the future state of their outcomes (Funtowicz and Ravetz 1993).

For this reason, such conclusions indicate adjusting our epistemological stance to what can be called *epistemological humility*. Epistemological humility accepts limits to human knowledge of the world, especially pertaining to future states, and has ramifying theoretical implications for intergenerational justice. Epistemological uncertainty in ascertaining the resiliency boundaries of ecosystems and in not knowing what technologies will be developed when, merit a stance that minimizes potential known risks, even if they are unlikely, if the consequences of the risk could immensely impact human populations.

2.4 Possibility Options of Future Generations and Unjust Constraints

Part of intergenerational justice includes not unfairly externalizing costs into the future for present benefits. Expectations of certain future (technological) developments to deal with deliberately created harms (the extent of which is not fully known), however, already lock future people into focusing energy and resources on addressing these harms. More than trivial path dependency, when the present generation makes decisions regarding resource use of nonrenewable resources, or reduces the reproductive potential of renewable resources, they in effect constrain the possible decision set future generations can make (Humphrey 2001). But the ability of future generations to make free decisions regarding what would be preferable is no longer an option when certain nonrenewable resources are used up and no longer available, or when renewable resources now operate in a different climatic context constraining their fecundity.

A second layer of dependency is created when current generations induce *deliberately* created harms, affecting social and ecosystemic processes in such a way that future generations will be forced to contend with to lead a good life. GMOs, over-prescribing antibiotics, nuclear power with its associated waste disposal, and geoengineering are examples of

innovations that deliver seemingly immediate benefits, but are entirely contingent upon further future technological development to solve the respective problems of evolving *Bacillus thuringiensis* resistant superbugs, penicillin-resistant superviruses, how to safely dispose of nuclear waste, or how to perpetuate a livable climate through reversing the causes rather than the symptoms of climate change. In short, such harms are deliberately created—though they are not regarded as harms because those propagating them expect and rely upon continued future technological progress to solve them before they ever become unsolvable problems. Bringing new technologies into the world without any knowledge of an off switch, when it is known that there will be future problems to be dealt with, is problematic in regards to intergenerational justice. Panglossian bets on progress set theories up for failure and humans for injustice when included as an essential component to achieving promised just future outcomes.

Self-reflexive theorists sincerely wishing to accurately account for flaws or hurdles to theoretical felicity must guard against blinkered optimism regarding future generations' abilities to overtake or reverse harms perpetrated by the present generation. Otherwise, optimistic theories legitimize excess externalization to future generations the present costs of activities benefitting the present generation (or portions thereof (Luke 2013)). Imputing to future generations the development of new technologies to clean up the messes previous generations caused as a necessity condition for continued survival is a suspect wager that violates any conception of intergenerational justice. Threshold theories of intergenerational justice are not unique in their unexamined belief in progressivism; but by setting minimal thresholds of justice, and then aiming *at* them, rather than above, or much above them, they capitulate to the same implausible infallibility of future events.

Attention to providing stable ecosystems and social systems requires epistemological humility. The increased risks humans face today from environmental instability arise not from a lack of development or technological innovation, but as "unintended consequences of modernity" (Beck 1992, 21). Politics often assumes "policy can always catch up with history" (Gunderson and Holling 2002, 379), and there remains the risk that "[s]ociety may be lulled into a false sense of security by smooth projections of global [climate] change," as awareness of potentially abrupt changes does not fit political timelines or human perceptions of risk (Len-

ton et al 2008, 1792). Accounting for these risks and aiming to minimize them can at best be partially accomplished, for their perceptibility is always uncertain and the linearity of straightforward cause-effect mechanisms dubious.

2.5 Systems Theory and Buffer Room

Brisk et al (2010) examine ecological thresholds where because of excess pressure, seemingly stable ecologies exceed their resiliency potential and flip into alternative stable states. The existence of multiple stable ecosystemic states, also known as punctuated equilibria, means that a given system, if overly stressed, can shift to a new "normal" set of functions completely different from the previous normal structural arrangements. Gunderson and Holling explain: "The slow erosion of key controlling processes can abruptly flip an ecosystem or economy into a different state that might be effectively irreversible" (2002, xxii). This phenomenon can occur in social systems and ecosystems. These other stable states however, may be undesirable, such as political governance switching from a democracy to a tyranny, or a forest turning into plains or desert. If stable institutions are a hallmark of intergenerational justice, as Rawls and others claim them to be, then strengthening resiliency will be paramount to achieve intergenerational justice.

Resiliency is predicated on increasing the "redundancy, diversity, and slack" in a given system (Gallopín 2002, 390). As Norton (1999) has acknowledged, systems theory affects how theories of intergenerational justice must be conceived. Thresholds of justice have implications for how we consider ecological thresholds. There is also an exceedingly complex relationship between ecological thresholds and thresholds of justice, and the firmer a theory's commitment to strong sustainability and constant natural capital, the more resonant this relationship becomes. While this relationship cannot be addressed in a single article, complex systems theory does explain how punctuated equilibrium, irreversibility, contingency, uncertainty, risk, and ecological thresholds can be fruitfully incorporated into theories of intergenerational justice, insofar as they call for buffer room (or "slack") in designating thresholds of justice. Recognition of tipping points between steady-state equilibria and the non-linearity of social and ecosystem processes instructs theories of intergenerational justice to not rely on business-as-usual scenarios of development or progress.

Yet, none of the threshold theorists mentioned here have proposed including buffer room above what they designate is minimally required for justice. Aiming to overshoot minimum just/unjust thresholds would be a first step in constructing a theory of intergenerational justice that takes into account uncertainty, contingency, and complex ecosystem theory. Current understandings that complex systems work "elliptically" rather than linearly, accumulating unfelt pressure before the dam bursts, can benefit theories of intergenerational justice. Epistemological humility can also serve to incorporate more realistic thresholds of savings, as overshooting minimum thresholds increases the likelihood such theories could provide (at least) the minimal level of justice proposed, rather than falling below that minimal threshold.

This first level of analysis, nonetheless, fails to provide a rational theory of intergenerational justice that is universalizable as a standard for all generations. For if the duty to deliver future justice is a strong one, merely tacking on extra bequeathments to account for contingencies still skirts the question of evolving circumstances requiring novel strategies. And perhaps the realization that there can be no failsafe guarantee of future justice is precisely the problem with threshold *conceptions* of intergenerational justice, or perhaps even binary conceptions of justice *simpliciter*. No matter the preparations for intergenerational justice, even with substantial present-generation sacrifices, no arrangements can guarantee future outcomes in a system that ultimately cannot be controlled from within. Because humans are emergent within the (eco)system in which we live, we are forever limited in our ability to influence it, especially according to predictable outcomes when we act. The same actions in one moment may produce vastly different outcomes in another moment, when other variables known or unbeknownst to us have altered.[16] For this reason, I propose approaching intergenerational justice from another angle, the *via negativa* of harm reduction.

3. HARM REDUCTION AS A *VIA NEGATIVA* APPROACH TO INTERGENERATIONAL JUSTICE

Squaring intergenerational justice with social justice in a way that obviates the MSY problem of toeing the line of unsustainability and injustice requires a different approach. Rather than merely adding buffer so that intergenerational duties require more than just a minimum amount of

bequeathment permitting for minor disturbances above a calculated minimum, the previous section indicated the hazards such savings wager—even if buffered thresholds are more likely to produce future justice than minimal conceptions. Embracing the fact of uncertainty, the *via negativa* of harm reduction reconceptualizes what intergenerational justice means and how it is delivered. Instead of promising a certain amount of savings, the *via negativa* confronts current harms that lead to intergenerational injustice.

Such a concept of justice might be called pragmatic, as it abstains from adhering to an absolute sufficientarian scale of binary just/unjust outcomes. Harm reduction envisions a spectrum of more-or-less justice as more genuine in concept and practice. Rejecting minimum thresholds of justice does not mean aiming not for some basic level of life quality, welfare or capacities, above which we are indifferent. It means rather concentrating on reducing current harms that probably lead to future injustices, focusing on the potentially most threatening. Harm reduction can also address egalitarian and prioritarian concerns, the latter asserting that "the value of a benefit, or the disvalue of a burden, diminishes as its recipient becomes better off" (Casal 2007, 296). Egalitarians are concerned with reducing harms to the worst-off in the current generation, and in other generations provided that such savings do not harm the current worst-off. Harm reduction takes into account that addressing many of the (environmental) harms most negatively affecting the worst-off will also benefit—though perhaps to a lesser degree—those better off. This is a positive externality of the *via negativa* harm reduction approach.

It is precisely the current worst-off as well as future generations that harm reduction endeavors to boost through addressing the most egregious current and predictable environmental damages. But this relationship isn't so clear cut as it seems. Tremmel articulates a possible but dubious linkage between social and intergenerational justice: "benefiting the least favored today…would automatically also realize intergenerational justice because it would improve the status of the least favored tomorrow" (2006, 8). As clarified in the thought experiment of the pernicious effects of universalism in Section 2, I question how automatically distributive justice leads to intergenerational justice. The fallacy of Tremmel's argument is illustrated when a polity exhausts its nonrenewable resources to help the welfare of those worst off today, rendering the entire polity worse off in the future

(see Reynold 2004 or Gowdy and McDaniel 1999 for a case study of this scenario). Nonetheless, one of the necessary (but not sufficient) requirements of intergenerational justice (and perhaps an expedient way to get there) involves raising the welfare of the current generation's least fortunate members in a sustainable way. Instead of focusing solely on economic development for welfare betterment, however, the welfare of the worst-off also improves through the *via negativa* of reducing environmental harms affecting current and future generations (Norton 1991, 1992a). Certain environmental degradation can be thought of as unqualifiedly harming humans, with compounded degradation harming future generations even further.

Where to go from here in terms of positing a positive principle for reconciling how to reduce harms? One approach has been to distinguish between "subsistence" and "luxury" emissions and consumption (Shue 1993). Supporting this reasoning, Daly claims "the basic needs of the future should take precedence over the extravagant luxury of the present" (1996, 36). This theoretical optic differentiates between identical substantive harm consequences based on the purpose for which these harms were caused, regulating more permissively for harmful actions that support subsistence welfare and more strictly against harms produced for luxury purposes. Cowen and Parfit (1992) also make the case that we should distinguish between needs and extra-necessary desires in determining what we should sacrifice for the future.

Adherents to such a view hold that "future generation needs should have precedence over present generation wants. In other words, the social discount rate will only come into operation at the level of need satisfaction across generations" (Dobson 1998, 114). Once the difference between basic needs and luxury needs is resolved (no simple matter, that!), this solution offers promising headway in parsing the impasse between distributive justice and intergenerational justice, which as indicated in this article's first section, is the primary reason why threshold theories offer so little in going beyond the minimal call of intergenerational duty.

If present consumption is not evaluated according to the atavistic economic device of infinite exchangeability, then allowing regulation of luxury environmental harms changes the landscape of justice. The lump sum of goods to be considered for distribution—intra- or intergenerationally—grows. We can now distinguish between savings to future generations that

cause harms to present people versus savings that cause inconveniences (Norton 1992). And if interchangeability is disallowed, and the health of ecosystems as a necessary condition for stability affirmed, then most of these savings are likely to benefit the reduction of human harms on ecologies, and hence reduce environmental harms, including instabilities, for humans.

Because environmental justice can be understood as a part of distributive justice, reducing looming ecosystem harms will also help address environmental injustices. As our economies move to renewable technologies, the people in the Niger Delta will be able to fish again. As we close coal factories, oil refineries, and clean up superfund sites, all which have been historically located in poorer neighborhoods (Szasz 1994), persisting economic disparities will cease to necessarily entail abject environmental disparity, and public health will also be more equitably distributed. As we move away from large scale monocropping using pesticides and fertilizers in favor of more regional and organic forms of farming (United Nations Conference on Trade and Development [UNCTAD] 2013), rural workers and families will enjoy potable water as a positive externality. All of these reduced harms benefit real people living now, even if some of their positive effects may take some time before ecosystems noticeably regenerate. Especially due to the lag time between stopping harms and the possibility of ecosystem resilience and human benefit, this delay suggests further urgency for such projects both serving distributive and intergenerational justice.

Harm reduction can also address one of the more pervasive problems intergenerational justice faces: How can members of present generations, who are not well off, be asked to sacrifice for future generations, when they themselves seek redress? Surely requiring that the world's poor sacrifice or suffer for the sake for future people is anathema to our own moral intuitions (Beckerman and Pasek 2001), as well to their dignity and a minimal level of wellbeing. Harm reduction argues that there exist present harms in terms of excess "bads" such as pollution, toxins, exploitative labor practices, etc., that can be reduced, or more equitably redistributed (Feinberg 1984).

A theory of intergenerational justice incorporating sustainability and social justice must address the problem of distribution. Rather than requiring that we harvest more resources to make the pie bigger, the pie

itself must be more equitably distributed. Rawls' *coup de maître* was precisely this: to wed and balance the concepts of equity and justice in a framework that supports individual liberty and just institutions. Recasting egalitarian ideals in terms of justice, the egalitarian position no longer has to be antipodean to intergenerational justice, nor to sustainability. Under the justice of Rawls' original position, we could then include not only the fair distributions of social goods, but also an arrangement to more fairly distribute many of the social and ecological "bads" that cause (environmental) injustice.

By focusing on reducing harms to future generations as a matter of justice rather than promising certain levels of future attainment predicated on rickety assumptions, intergenerational justice as an ethical theory gains traction practicably. Threshold theories may be analytically (if not practically) suited for the distribution of goods, but they have little or no capacity to deal with distributing "bads." Especially environmental risks or harms have been systematically overlooked by threshold intergenerational justice schemes (Hiskes 2006, 90). If justice's relationship with environmental sustainability isn't one of antagonism (Dobson 1998), but instead "*sustainability is a necessary condition for justice*" (Langhalle 2000, 296, italics in the original), as has been sketched here through keying in on stability, then focusing on reducing serious and long-term environmental harms will benefit both the worst-off of the current generation and future generations.

Rawls' theory of distributive justice and institutional stability is in no way predicated on an economic system of endless growth in a finite ecology. Rawls was also aware of overpopulation, overconsumption, and environmental degradation as issues that must be attended to. For rights and liberties to be exercised, Rawls acknowledges that basic needs must first be met. *The Law of Peoples* notes an important addendum to Rawls' main theory:

> [T]he first principle covering the equal basic rights and liberties may easily be preceded by a lexically prior principle requiring that citizens' basic needs be met, at least insofar as their being met is necessary for citizens to understand and to be able fruitfully to exercise [their] rights and liberties. (Rawls 1999b, 107)

Intergenerational justice based on bequeathing stable just institutions requires certain minimal ecological goods and services to ensure the liberties

of just institutions are meaningful and resilient. A livable climate, and ecosystems providing food, water and other environmental services on which we depend, are part of this basket of meeting citizens' basic needs and rights, and are preconditions for meaningful political participation.

4. DISCUSSION

If stability is a cardinal virtue of intergenerational justice for preserving just institutions, then this also requires a minimal conception of ecological sustainability and stability. Most theorists of intergenerational justice, however, do not adequately take complex ecosystemic principles into account when developing their theories of intergenerational justice, and instead adopt bequeathment thresholds that relatively benefit current generations (not demanding too much sacrifice) while providing not enough buffer between proposed bequeathments and the minimal requirements of intergenerational justice they espouse. These theories are further complicated by the uncertainties of future temporality; future problems and crises unforeseeable by current theories may arise, changing the status quo. Thus, theories that hypostatize universal principles of intergenerational justice (bequeathment packages, ratios, reciprocity, substitutable or nonsubstitutable goods according to given minimal levels) invariably defeat their own theories by applying this universalizing principle. A more pragmatic and theoretically coherent principle then must include updateability (rather than static content and/or amount of bequeathments), and iterability (regularly updating needs and definitions of justice according to changing circumstances) (Arcuri 2007). And rather than focusing merely on short-term benefit for the worst-off, entrenched systemic irrationalities such as environmental bads that pose the greatest potential for harm should be addressed. The harm-reduction strategy simultaneously provides for more justice to distant future generations while also reducing the severities of extreme environmental injustices for the current worst-off.

Intergenerational justice demands that theorists confront the problem of uncertainty endemic in any sort of future-oriented work. Problems that contain high stakes and uncertainty, and are future-oriented such as intergenerational justice, can benefit from the work mounted by scholars adhering to "postnormal" approaches to political-scientific questions (Funtowicz and Ravetz 1993). High degrees of uncertainty do not necessarily mean that the chances of an event occurring are diminished or should be taken more lightly (Parfit 1984). Just as scholars in science

studies call on the Intergovernmental Panel on Climate Change (IPCC) for more "explicit reflection on known and unknown unknowns and more openness for dissent in IPCC process and reporting" (van der Sluijs 2012, 190), likewise this article is a call for theorists of intergenerational justice to recognize the repercussions of including systems-theoretical concerns as well as epistemological limits into universalizable theories that hypostatize present givens.[17]

Intergenerational justice is a special case of justice in which future outcomes cannot be predicted, and environmental limits are indeterminate, not lending themselves to hard-and-fast estimations of how much pollution environments can absorb or how much extraction or degradation can occur in a given ecosystem (or the biosphere) before fundamental phase shifts occur. For these reasons, harm-reduction guidelines to intergenerational justice in light of epistemological humility might include stipulations that: (1) renewable resources may only be used at or below their rate of natural replenishment,[18] (2) non-renewable resources may only be used at the rate they are replaced by functionally equivalent renewable substitutes, (3) pollution must be minimized, and (4) non-biodegradable (non-absorbable) pollutants must be phased-out (SRU 2002). While these environmental management guidelines of strong sustainability nonetheless are specifications of thresholds of intergenerational justice predicated on environmental factors, and can by no means assure delivering just institutions, the practical aspect of environmental harm reduction could pragmatically converge on such guidelines.

The critique of threshold theories and the *via negativa* proposal as a pragmatic and theoretical method circumventing the conceptual flaws in threshold theories assumes an anthropocentric posture, as are most non-deep green theories of intergenerational ethics.[19] However, contextualizing human welfare in complex systems theory and taking seriously our epistemological limits in understanding the complexity of ecological life-support systems requires that we refrain from a purely functionalist perspective of ecosystems qua "ecosystem services." Such an approach tacitly maintains that ecosystems are dispensable and the processes ecosystems provide are reversible and reproducible (through employing technology, or substituting other ecological or natural-hybrid units). While here is not the place to engage with the ecosystem services debate, it is important, according to epistemological humility, to realize that the notion that human beings can exhaustively understand, and thus control,

manipulate, or artificially reproduce (should it come to that) ecosystem services, remains a prospect that cannot be relied upon.

5. CONCLUSIONS

This article has focused on thresholds—ecological and intergenerational—suggesting that a coherent theory of intergenerational justice requires addressing existential uncertainty as understood in complex systems theory in order to deal with the problem of institutional stability. I focused on the ecological dimension of intergenerational justice to demonstrate that ecosystems are constantly changing and can quickly shift to alternative stable states when overwhelmed by stressors, sometimes unpredictably so, as specific tipping points for various ecological vectors can never be exhaustively predetermined. Even extra consideration for sustaining resilient ecologies—buffer room—does not address the theoretical weakness of scales of justice based on binary thresholds of sufficiency. To not take foreseeable nonlinear events into account—such as climate change, destabilized ecosystems, the consequences of overfishing, for example—is to leave future generations in the lurch.

Intergenerational justice must be reconceived according to the real uncertainties confronting present and future generations. While we cannot prepare for unknown unknowns, we can plan and take into account those known unknowns that could negatively affect future generations, and are morally culpable if we do not (Parfit 1984; Parfit and Cowen 1992; Boersema 2001). Intergenerational justice demands of us that we do not opportunistically ignore liminal problems or unlikely situations, and asks that we attend to the complexities of the world, however inexhaustible a task. Moreover, incorporating systems theory and punctuated equilibrium into conceptions of intergenerational justice lends them a three-dimensionality that many have hitherto lacked.[20]

Intergenerational justice is never singular but instead always plural. Instances of justice as well as injustice are matters of degree rather than sufficiency. Like climate change, we can—to the extent possible, given uncertainty of the future—make political decisions that will afford less or more stabilization and justice. It is important that as an ethical issue, intergenerational justice not remain solely a theoretical issue, but that we give thought to situating it in related discourses that impact outcomes, practical and theoretical. Contextualizing and problematizing progressivist notions of intergenerational justice doesn't only make for more earnest

theorizing; it also produces theories capable of meshing with complex scientific models of how the world works in its entanglements, which may even lead to more just futures.

The *via negativa* harm reduction model but scratches the surface of alternative approaches to intragenerational justice (e.g., through environmental justice). Yet, the need for epistemological humility to drive us to act to reduce harms in the face of uncertainty is echoed by Elinor Ostrom:

> [C]ontinuing to wait may lead to missing the chance to make significant adaptations and mitigations in time to prevent tragic disasters. There has been too much focus on achieving a given reduction of greenhouse gas emissions rather than recognizing the grave risk we face. Reducing emissions *now* is more urgent than reaching an international agreement to reduce emissions by a given percentage, which might not be achieved for some time into the future. We do not face a situation where little harm is caused by overuse until we pass a given threshold, as may be the case with some renewable resources. (2010, 28; italics in original)

Ostrom's admonition that "there has been too much focus" on reaching agreement on what constitutes an acceptable environmental threshold recognizes the necessity for pragmatic and contingent environmental harm reduction, iteratively and incrementally fulfilled to preserve quality life and just institutions into the far future.

ACKNOWLEDGEMENTS

I wish to thank Konrad Ott, Zachary Hendlin, Fred Lee, Lieske Voget-Kleschin, Lily Ross and an anonymous reviewer for valuable comments.

NOTES

1 As typified—but by no means exclusively—in sufficientarianism (Beckerman and Pasek 2001, Page 2007, Meyer and Roser 2009; also see Casal 2007 for a similar critique).
2 This second sort of threshold has been popularized as the "tipping point" in punctuated equilibrium. See Liu et al (2007), Gunderson and Holling (2002), and Brisk et al. (2010), for concrete examples of how this process works, as well as Rawls (1971, ff. 400, esp. 400 fn. 3).
3 *The Limits to Growth*, first published in 1972, was the first time Earth systems capacity limits were established in environmentalism as a real and uncircumventable problem.
4 For conceptual clarity, these obligations are confined within the bounds of the solitary state (Rawls 1971), though increasingly intergenerational justice the-

orists are proposing more comprehensive global proposals, recognizing the transnational quality of environmental issues (Langhelle 2000, Schultz et al. 2008, Vanderheiden 2008). While polity self-sufficiency is in practice unlikely, and the environmental ramifications of Rawls' theory are epiphenomenal, as a theoretical requirement it serves to avoid applying the difference principle globally beyond a given polity. Rawls' aim for polity self-sufficiency suggests that a polity may not inflict negative environmental externalities on other polities (Rawls 1999b, 39 and 106–7), which Langhelle interprets as Rawls' "implicit assumption about environmental self-sufficiency" (2000, 308).

5 Rawls writes, "The life of a people is conceived as a scheme of cooperation spread out in historical time. It is to be governed by the same conception of justice that regulates the cooperation of contemporaries" (1971, 257). Rawls' "motivational assumption," that current generations will be incentivized to care for the future for future people's welfare because of self-interest for their children's welfare, has been widely discredited as an insufficient reason for intergenerational justice (Paden 1997, see MacClellen 2013). De Shalit's (1995) communitarian motivations more convincingly conceive intergenerational justice through a better developed mechanism of Rawls' original criticized motivational proposal. In *Political Liberalism*, Rawls (2005) clarifies his tack, and while Barry claims that he could have made the veil of ignorance "thicker" and included uncertainty as to what generation participants in the original position would end up in (Barry 1995, 886), Rawls instead postulates the universality principle: that whatever principle is adopted, the adopting generation would have to wish that every previous generation had also adopted it. Of course, as Dobson (1998, 122) points out, this leads back to the problem Laslett and Fishkin (1992) identified of dividing a finite amount of goods across an infinite number of generations. But it is Rawls' Kantian universality principle initially developed in *A Theory of Justice* and expanded through his own and others' work that is interrogated here.

6 The second section of the paper discusses barriers to stability (such as environmental collapse) and what can be done to mitigate these threats. (But of course, because of the very constituent uncertainty of the future, any attempts to mitigate threats will never be fail-safe).

7 Holland defines sustainability in similar terms to intergenerational justice as configured here: "something or other is supposed to be kept going, or at any rate not allowed to decline, over time" (Holland 1994, 169).

8 In the original position, the veil of ignorance is "complete" in that persons in the original position have no information as to which generation they belong (Rawls 1971, 287). Rawls asserts, "These broader restrictions on knowledge are appropriate in part because questions of social justice arise between generations as well as within them, for example, the question of the appropriate rate of capital saving and of the conservation of natural resources and the environment of nature" (1971, 118–19).

9 Although capability theorists are not discussed here, even capability theorists have thresholds—that of "dignity" or a "good life." Sen writes, "The neglect and deterioration of the natural environment... is a hugely serious problem and one that is closely linked with the negative effects of human behavior, but the problem does not arise from any desire of people today to hurt those yet to be born, or even to be deliberately callous about future generations' interests. And yet, through lack of reasoned engagement and action, we do still fail to take adequate care of the environment around us and the sustainability of the requirements of good life" (2009, 48). Theorists with absolute standards conceive intergenerational justice according to different welfare criteria (capacities rather than specific bequeathments) than relative justice theorists do, but nonetheless have minimal measures of wellbeing that if not met, signal injustice. See Page (2007, 466) for a critique of Sen and Nussbaum's "threshold of dignity."

10 Norton (1999) refutes Parfit's (1984, 444) argument that ignorance of the future effects of present policies is exculpatory.

11 While political philosophy in the ethical tradition has never made strong claims to applicability, insofar as environmental political theory is concerned with sustainability, conceptual work must take praxis into account, even if theories are meant to give us orienting principles in the constantly moving world of politics. On this important point of applicability, Rawls writes, "In actual affairs, nonideal theory is of first practical importance and deals with problems we face every day" (1999a, 537).

12 This begs the question whether calling a given state of affairs just definitionally, actually achieves this thing called justice experientially for future peoples. And if the two do not coincide, can one be said to have "achieved" justice or "saved for" justice, even if such savings were patently insufficient for the actual needs future people have? One could also argue that what Page (2007) calls currencies of justice for which this can happen do not constitute convincing currencies of justice (precisely because future injustices can occur). Currencies that measure the preconditions of welfare rather than those currencies directly measuring welfare (capabilities approaches) remain restrictive. However, one could ask if capabilities approaches, in not concerning directly with preconditional bequeathments, would have anything to go on should substitutability not wash out. Without the preconditions for capabilities, the development of capabilities is also impaired.

13 Both Rawls' and Habermas' universalizing principles have been critiqued precisely on this ground that what they take to be universals or transcendent models actually reflect particular cultural and historical developments (for instance, see Young 1990, Ch. 4).

14 Or in the words of Frank Egler (1977): "Nature is not only more complex than we think, but more complex than we *can* think" (2, italics added).

15 On the slipperiness of using capital as a catch-all Norton (1999, 293) relates,

"It is difficult, however, once one has reduced all concern for the future to a matter of maintaining general capital over time, to specify any particular concerns for the distant future." Barry likewise finds this terminology troublesome: "What helps to obscure the point at issue is the terminology of 'capital' itself…. But the 'fungibility' school…insist[s] on fungibility in principle; whether or not everything can be substituted for in practice is a matter of fact on which they do not have to be dogmatic. But if I am right the real dispute is at the level of principle, and is not perspicuously represented in terms of the properties of different kinds of capital" (1999, 103).

16 An example of the same action or protocol producing vastly different results in different existential situations is how stable assumptions of land use standardized in the Lockean environmental epoch of historical colonialism leads to perverse consequences when applied to contemporary "post-Lockean" contexts of land scarcity (Hendlin 2014).

17 Norton (1992, 1999) has pointed out that the vast majority of theories of intergenerational justice fail to recognize scientific understandings of ecological and complex systems, leading to accepting the myth of substitutability. Yet, his answer to the dangers of irreversibility was to introduce a stopgap measure that would require within all reasonable means, the protection against certain catastrophic impending ecological and social events. By instituting a Safe Minimum Standard, Norton's state of emergency would kick in once research showed that irreversible harms were imminent. Norton admits however, that "the information necessary to act sustainably in this sense would be very hard to obtain" (1992, 104), and that his theory of prevention via purely scientific triggers "places a heavy burden on scientific models" (105). Perhaps in an era of the Precautionary Principle, placing such emphasis on scientific determination plausibly foisted the onus of overrunning such ecological thresholds on development (Beekman 2004); but in an era of Climate Gate and think-tank fueled climate skepticism, reference to science as a value-neutral uninterested arbiter of risk is now contested (Arcuri 2007; Boersema, 2001; Van der Sljuis 2012).

18 Trying to bypass replenishment rates (for example, genetically engineering salmon to grow faster) is not acceptable in a systems view, as there will inexorably be adverse side-effects (in this case: fish that cannot reproduce, and over-foul their aqua-system).

19 The question of the theoretical purchase of adding non-anthropocentric arguments is clarified by Norton: "introducing the idea that other species have intrinsic value, that humans should be 'fair' to all other species, provides no operationally recognizable constraints on human behavior that are not already implicit in the generalized, cross-temporal obligations to protect a healthy, complex, and autonomously functioning system for the benefit of future generations of humans" (Norton 1991, 226–27). For an example of

an intergenerational theory of justice that includes nonhuman welfare, see Attfield (1998).

20 Notable exceptions include Norton (1992, 1999).

REFERENCES

Arcuri, Alessandra. 2007. "Reconstructing Precaution, Deconstructing Misconceptions." *Ethics and International Affairs*, 21(3): 359–79.

Attfield, Robin. 1998. "Environmental Ethics and Intergenerational Equity." *Inquiry* 41(2): 207–22.

Barry, Brian. 1999. "Sustainability and Intergenerational Justice." In *Fairness and Futurity: essays on environmental sustainability and social justice*, edited by Andrew Dobson, 93-117. New York: Oxford University Press.

———. 1995. "John Rawls and the Search for Stability." *Ethics* 105: 874–915.

———. 1978. "Circumstances of justice and future generations." In *Obligations to future generations*, edited by R.I. Sikora & B. Barry, 204–48. Philadelphia, PA: Temple University Press.

Beck, Ulrich. 1992. *Risk society: towards a new modernity*. London, UK: Sage.

Beckerman, Wilfred. 1997. "Debate: Intergenerational Equity and the Environment." *Journal of Political Philosophy* 5(4): 392–405.

Beckerman, Wilfred, and Joanna Pasek. 2001. *Justice, Posterity, and the Environment*. New York: Oxford University Press.

Beekman, Volkert. 2004. "Sustainable Development and Future Generations." *Journal of Agricultural and Environmental Ethics* 17: 3–22.

Boersema, Jan J. 2001. "How to Prepare for the Unknown? On the Significance of Future Generations and Future Studies in Environmental Policy." *Environmental Values* 10(1): 35–58.

Bostrom, Nick. 2013. "Existential Risk Prevention as Global Priority." *Global Policy* 4(1): 15–31.

Briske, David D. et al. 2010. "Catastrophic thresholds: a synthesis of concepts, perspectives and applications." *Ecology and Society* 15(3): 1–12.

Casal, Paula. 2007. "Why Sufficiency is Not Enough." *Ethics* 117(2): 296–326.

Cowen, Tyler. 2007. "Caring about the Distant Future: Why It Matters and What it Means." *University of Chicago Law Review* 74(1): 5–40.

Daly, Herman. 1996. *Beyond Growth: The Economics of Sustainable Development*. Boston: Beacon Press.

de-Shalit, Avner. 1995. *Why Posterity Matters*. New York: Routledge.

Dobson, Andrew. 1998. *Justice and the Environment: Conceptions of Environmental Sustainability and Theories of Distributive Justice*. New York: Oxford.

Egler, Frank E. 1977. *The Nature of Vegetation: Its Management and Mismanagement: An Introduction to Vegetation Science*. Bridgewater CT: Connecticut Conservation Association.

Ekeli, Kristian Skagen. 2004. "Environmental Risks, Uncertainty and Intergenerational Ethics." *Environmental Values* 13(4): 421–48.
Farrell, Katherine N. 2009. *Making Good Decisions Well: A Theory of Collective Ecological Management*. Aachen: Shaker Verlag.
Feinberg, Joel. 1984. *The Moral Limits of the Criminal Law. Vol. 1. Harm to Others*. Oxford, UK: Oxford University Press.
Foster, John B. 2012. "The Planetary Rift and the New Human Exemptionalism: A Political-Economic Critique of Ecological Modernization Theory." *Organization & Environment* 25: 211–37.
Funtowicz, Silvio and Jerome Ravetz. 1993. "Science for the Post-Normal Age." *Futures* 25: 739–55.
Gallopín, Gilberto C. 2002. "Planning for Resilience: Scenarios, Surprises, and Branch Points." In *Panarchy: Understanding Transformations in Human and Natural Systems*, edited by Gunderson, Lance, and C.S. Holling, 361–94. Washington, DC: Island Press.
Gosseries, Axel. 2001. "What Do We Owe to the Next Generation(s)?" *Loyola of Los Angeles Law Review* 35 (293): 293–354.
———. 2005. "Cosmopolitan Luck Egalitarianism and the Greenhouse Effect." *Canadian Journal of Philosophy*, Supplementary Volume 31: 279–309.
———. 2008. "On Future Generations' Future Rights." *The Journal of Political Philosophy* 16 (4): 446–74.
———. 2009. "Three Models of Intergenerational Reciprocity." In *Intergenerational Justice*, ed. A. Gosseries and L.H. Meyer. Oxford, UK: Oxford.
Gowdy, J.M., and C.N. McDaniel. 1999. "The Physical Destruction of Naruru: An Example of Weak Sustainability." *Land Economics* 75: 333–38.
Gunderson, Lance, and C.S. Holling, eds. 2002. *Panarchy: Understanding Transformations in Human and Natural Systems*. Washington, DC: Island Press.
Haberman, Jürgen. 1996. *Between Facts and Norms*. Cambridge, MA: MIT Press.
Hendlin, Yogi H. 2014. "From *Terra Nullius* to *Terra Communis*: Reconsidering Wild Land in an Era of Conservation and Indigenous Rights." *Environmental Philosophy* 11(2).
Hiskes, Richard P. 2006. "Environmental Human Rights and Intergenerational Justice." *Human Rights Review* April-June.
Holland, Alan. 1994. "Natural Capital" In Robin Attfield and A. Belsey (eds). *Philosophy and the Natural Environment*. Cambridge, UK: University Press.
Humphrey, Mathew. 2001. "Three Conceptions of Irreversibility and Environmental Ethics: Some Problems." *Environmental Politics* 10(1): 138–54.
Intergovernmental Panel on Climate Change (IPCC). 2007. "Summary for Policymakers." In *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Chang*e, edited by Solomon, S., D. Qin, M. Manning,

Z. Chen, M. Marquis, K.B. Averyt, M.Tignor and H.L. Miller. New York: Cambridge University Press.
Langhelle, Oluf. 2000. "Sustainable Development and Social Justice: Expanding the Rawlsian Framework of Global Justice." *Environmental Values* 9: 295–323.
Larkin, P. 1977. "An Epitaph for the Concept of Maximum Sustainable Yield." *Transactions of the American Fisheries Society* 106: 1–11.
Laslett, Peter, and James S. Fishkin, eds. 1992. *Justice between Age Groups and Generations*. New Haven, CT: Yale University Press.
Lenton, Timothy M., et al. 2008. "Tipping elements in the Earth's climate system." *Proceedings of the National Academy of Sciences* 105 (6):1786–93.
Liu, Jianguo, et al. 2007. "Complexity of Coupled Human and Natural Systems." *Science* 317: 1513–16.
Lomborg, Bjørn 1998. *The Skeptical Environmentalist: Measuring the Real State of the World*. Translated by H. Matthews. 2001 ed. New York: Cambridge University Press.
Luke, Timothy. 2013. "The Anthropocene and Freedom: Terrestrial time as political mystification." *Platypus Review* 60: 2.
MacClellan, Joel. 2013. "How (Not) To Defend A Rawlsian Approach To Intergenerational Ethics." *Ethics and the Environment* 18(1): 67–85.
Meyer, Lukas H., and Dominic Roser. 2009. "Enough for the Future." In *Intergenerational Justice*, edited by A. Gosseries and L.H. Meyer. New York: Oxford University Press.
Mol, Aurthur P.J. 2003. *Globalization and Environmental Reform: The Ecological Modernization of the Global Economy*. Cambridge, MA: MIT Press.
National Research Council. 2010. *Advancing the Science of Climate Change*. Washington, DC: The National Academies Press.
Norton, Bryan. 1991. *Toward Unity Among Environmentalists*. New York: Oxford University Press.
———. 1992. "Sustainability, Human Welfare, and Ecosystem Health." *Environmental Values* 1(2): 97–111.
———. 1992a. "Epistemology and Environmental Values." *Monist* 75(2): 208–26.
———. 1999. "Ecology and Opportunity: Intergenerational Equity and Sustainable Options." In *Fairness and Futurity*, edited by Andrew Dobson, 118–150. Oxford: University Press.
———. 2002. "The Ignorance Argument: What Must We Know to be Fair to the Future?" In *Economics, Ethics, and Environmental Policy: Contested Choices*, edited by Daniel W. Bromley and Jouni Paavola, 35–52. Oxford, UK: Oxford University Press.
———. 2005. *Sustainability: A Philosophy of Adaptive Ecosystem Management*. Chicago: University of Chicago Press.

Nussbaum, Martha. 2006. *Frontiers of Justice: Disability, Nationality, Species Membership*. Cambridge, MA: Harvard University Press.

Ostrom, Elinor. 2010. "A Multi-Scale Approach to Coping with Climate Change and Other Collective Action Problems." *Solutions* 1(2): 27–36.

Ott, Konrad. 2004. "Essential Components of Future Ethics." In *Ökonomische Rationalität und praktische Vernunft: Gerechtigkeit, Ökologische Ökonomie und Naturschutz*, edited by R. Döring and M. Rühs. Würzburg: Verlag Königshausen und Neumann.

———. 2009. "On Substantiating the Concept of Strong Sustainability." In *Sustainability, Natural Capital and Nature Conservation*, edited by R. Döring, 49–72. Marburg: Metropolis.

Paden, Roger. 1997. "Rawls's Just Savings Principle and the Sense of Justice." *Social Theory and Practice* 23: 27–51.

Padilla, Emilio. 2002. "Intergenerational Equity and Sustainability." *Ecological Economics* 41: 69–83.

Page, Edward A. 2007. "Justice Between Generations: Investigating a Sufficientarian Approach." *Journal of Global Ethics* 3(1): 3–20.

———. 2007a. "Intergenerational Justice of What: Welfare, Resources or Capabilities?" *Environmental Politics* 16(3): 453–69.

Parfit, Derek. 1984. *Reasons and Persons*. New York: Oxford University Press.

Ponthiere, Gregory. 2009. "The Ecological Footprint: An Exhibit at an Intergenerational Trial?" *Environment, Development and Sustainability* 11(4): 677–94.

Rawls, John. [1971] 1999. *A Theory of Justice*. 2nd Revised ed. Cambridge, MA: Harvard University Press.

———. 1999a. *Collected Papers*. Edited by S.R. Freeman. Boston: Harvard.

———. 1999b. *The Law of Peoples*. Cambridge, MA: Harvard.

———. 2005. *Political Liberalism*. New York: Columbia University Press.

Rat von Sachverständigen für Umweltfragen (SRU). 2002. *Umweltgutachten 2002*. Stuttgart: Metzler-Poeschel.

Raymond, Leigh. 2004. "Economic Growth as Environmental Policy? Reconsidering the Environmental Kuznets Curve." *Journal of Public Policy* 24(3): 327–48.

Sandel, Michael J. 1982. *Liberalism and the Limits of Justice*. Cambridge: University Press.

Schultz, Julia, Fridolin Brand, Jürgen Kopfmüller, and Konrad Ott. 2008. "Building a 'Theory of Sustainable Development': Two Salient Conceptions Within the German Discourse." *International Journal of Environmental and Sustainable Development* 7(4): 465–82.

Shue, Henry. 1993. "Subsistence Emissions and Luxury Emissions." *Law and Policy* 15(1): 39–59.

Solow, Robert. 1993. "Sustainability: An Economist's Perspective." In *Selected Readings in Environmental Economics* (3rd edition), edited by R. Dorfman and N. Dorfman pp. 179-187. New York: Norton.

Sen, Amartya. 2009. *The Idea of Justice*. Cambridge, MA: Belknap.

Szasz, Andrew. 1994. *EcoPopulism: Toxic Waste and the Movement for Environmental Justice.* Minneapolis: University of Minnesota Press.

Taleb, Nassim N. 2007. *The Black Swan: The Impact of the Highly Improbable*. New York: Random House.

Tremmel, Jörg. 2006. *Handbook of Intergenerational Justice*. Northampton: Edward Elgar Publishing.

United Nations Conference on Trade and Development (UNCTAD). 2013. *Wake Up Before its Too Late, Make Agriculture Truly Sustainable Now for Food Security in a Changing Climate*. United Nations Conference on Trade and Development. Trade and Environment Review 2013. September 18. Retrieved: Oct. 30, 2013. Available at: http://unctad.org/en/PublicationsLibrary/ditcted2012d3_en.pdf

United Nations Environment Programme (UNEP). 1992. "Framework Convention on Climate Change." In *UN World Summit on Sustainable Development*. United Nations Environmental Programme. Rio de Janeiro, Brazil.

Vanderheiden, Steve. 2008. "Climate Change, Environmental Rights, and Emission Shares." In *Political Theory and Global Climate Change*, edited by S. Vanderheiden. Cambridge, MA: MIT Press.

van der Sluijs, Jeroen P. 2012. "Uncertainty and Dissent in Climate Risk Assessment: A Post-Normal Perspective." *Nature and Culture* 7(2): 174–95.

van der Sluijs, Jeroen P. and Wim C. Turkenburg. 2006. "Climate Change and the Precautionary Principle." In *Implementing the Precautionary Principle: Perspectives and Prospects*, edited by E. Fisher, J. Jones, and R. von Schomberg, 245–69. Cheltenham, UK: Edward Elgar.

Weiss, Edith Brown. 1989. *In Fairness to Future Generations: International Law, Common Patrimony, and Intergenerational Equity*. Irvington-on-Hudson, NY: Transnational.

Williams, Mary B. 1978." Discounting Versus Maximum Sustainable Yield." In *Obligations to Future Generations*, edited by Richard Sikora and Brian Barry, 169–85. Philadelphia, PA: Temple University Press.

Wissenburg, Marcel. 1999. "An extension of the Rawlsian Savings Principle to Liberal Theories of Justice in General." In *Fairness and Futurity*, edited by Andrew Dobson, 173–98. Oxford, UK: Oxford University Press.

World Bank. 2012. *Turn Down the Heat: Why a 4°C Warmer World Must be Avoided*. Washington, DC: World Bank.

Young, Iris Marion. 1990. *Justice and the Politics of Difference*. Princeton: Princeton University Press.

Young, Michael D. 1993. *For Our Children's Children: Some Practical Implications of Inter-Generational Equity and the Precautionary Principle*. Canberra: Resource Assessment Commission.