

26 burden on low-income people, households in British Columbia that have an income below a
27 certain level are compensated through a tax credit system.¹

28 The question of how to fairly distribute costs of environmental precautions is
29 significant. Unfair distributions of costs and benefits are morally problematic, and precautions
30 that distribute costs unfairly may encounter resistance because they are viewed as illegitimate.
31 Yet the question of fair distribution of costs of precautions has received relatively little
32 attention in literature on the precautionary principle and environmental ethics. Some have
33 argued that distributional consequences should be taken into account when applying the
34 precautionary principle (Dickson 2005), and others have championed one distributional
35 principle or a set of principles in specific contexts, such as climate change (e.g., Neumayer
36 2000; Caney 2005; Page 2008). However, these proposals are importantly incomplete.
37 Recognizing the importance of fairly distributing costs of precautions raises the question of
38 how to distinguish fair from unfair distributions. And while a particular distributional
39 principle or set of principles may be salient in one context, a general account of the topic
40 requires a framework for considering several principles in tandem. Indeed, such a framework
41 is needed even for the analysis of single cases, wherein multiple plausible but competing
42 principles may be invoked, as is illustrated by cases we examine in section 4. In this paper,
43 therefore, we identify principles relevant to fairly distributing costs of precautions and
44 propose a framework for how to jointly apply them in a variety of circumstances.

45 We begin by articulating distributional principles relevant to our context, and by
46 examining their rationale in different kinds of considerations of responsibility and justice,
47 notably desert, rights, welfare, and equality. On this basis, a framework is proposed for the
48 fair distribution of precautionary costs. The framework consists of a default principle, called
49 Risk-Initiator Pays, in addition to further principles that can be invoked when there are strong

¹ <http://www2.gov.bc.ca/gov/content/taxes/income-taxes/personal/credits/climate-action> (accessed 25.04.2017).

50 moral reasons for sharing burdens. The structure and dynamics of the framework is illustrated
51 in Figure 1. The framework is intended to help decision-makers think more systematically
52 about distributional consequences of taking precautionary measures, thereby to improve
53 decision-making. Two cases – one about a ban on turtle fishing in Costa Rica, and one about a
54 deep-sea mining project in Papua New Guinea – are presented to show how the framework
55 can be applied.

56 The term ‘precautionary measure’ (for short, ‘precaution’) is used in this paper to refer
57 to any measure taken against a risk or hazard in order to reduce or negate it. Such measures
58 can be everything from outright bans or moratoriums on certain activities or technologies, to
59 less drastic measures to control or reduce risk, such as requirements to do further research to
60 map risks and benefits or to replace high risk technologies with lower risk technologies. In
61 many cases, such measures involve a reference to or application of the precautionary
62 principle,² which is highly influential in environmental policy (Trouwborst 2006; O’Riordan
63 1994; Steel 2015). But as we conceive of them in this paper, precautions may or may not
64 involve an explicit use or reference to the (or a) precautionary principle.

65

66 **2. Conflicting principles for distributing costs of precautions: a ‘non-ideal’ approach**

67 In *The Idea of Justice*, Amartya Sen (2011) asks us to imagine three children who disagree
68 about who should get to play with a flute. Anna says she should have it because only she
69 knows how to play it; Bob says he should have it because he has no other toys; and Carla says
70 she should have it because she is the one who made it. All three agree on the facts, but they
71 disagree about who should get the flute because each prioritizes a distinct principle of justice:
72 libertarian right to the fruits of one’s labour, which favours Carla, or economic equality,

² Roughly, the precautionary principle says that if there are reasonable grounds to believe that we are facing a significant environmental threat, some action should be taken against that threat even if there is scientific uncertainty about it; or at least, the lack of full scientific certainty should not be used as a reason *not* to take effective measures against the threat.

73 which favours Bob, or hedonistic utilitarianism, which (arguably³) favours Anna. The point of
74 the story is that focusing on a single principle is inadequate. Justice, Sen insists, requires
75 balancing reasonable principles or conceptions of fairness that often conflict in concrete
76 cases. Such an approach to justice is unlikely to take the form of a universal theory that
77 provides a transcendental conception of the perfectly just world – and indeed it need not do
78 so.

79 A more promising approach is to develop proposals that guide comparative judgments
80 about more or less just social arrangements in a specific type of context. Moreover, in
81 addition to principles of justice, such proposals should also pay attention to the pragmatics of
82 how proposed reforms would affect actual behaviours. Sen’s approach to justice, then, is an
83 example of ‘non-ideal theory’ (Valentini 2012), and the framework we propose here with
84 respect to fair distribution of costs of precautions is advanced in this spirit.⁴ Our framework
85 integrates several potentially conflicting principles relevant to fair distribution of costs of
86 precautions in order to guide comparative judgments about justice, while giving pragmatic
87 concerns about incentives their due consideration.

88 The first step in developing such an approach is to identify relevant principles and to
89 explain how their potential for conflict raises difficult questions of justice. That is what we do
90 in this section. The principles (table 1) have been selected and refined primarily on the basis
91 of two criteria. First, we aimed to include principles that have been discussed or applied in
92 connection with the distribution of costs of precaution or in related contexts such as public
93 finance and climate justice. Second, we aimed for a set of principles that were comprehensive
94 insofar as making it possible to consider the responsibilities and rights of all of the actors

³ As Sen observes, utilitarianism could also favor Bob on the basis of decreasing marginal utility, or Anna on the grounds that the right to keep what one has produces encourages economic productivity (Sen 2011, 13-14).

⁴ While non-ideal theory seeks to give due consideration to people’s actual behavioral patterns in moral and social situations – for instance the risk of partial compliance to agreements – ideal theory assumes an ‘ideal’ social world consisting for instance of rational moral agents tending to act in full compliance to agreements. For what is often considered a prime example of ideal theory, see Rawls (1971).

95 affected by precautions or their costs. Achieving the second of these aims required modifying
96 some principles to make them more general. In addition, to avoid ambiguity we divide the
97 notion that beneficiaries may have responsibility to bear costs of precautions into two separate
98 principles, one concerning beneficiaries of the risk generating activity and the other pertaining
99 to beneficiaries of precautions. To our knowledge, the latter of these principles has not been
100 previously discussed in the literature.

101 We begin by considering the Polluter Pays Principle (PPP). This is a principle for the
102 allocation of costs from preventive pollution control (Gaines 1991; OECD 1972), and a
103 means to internalize the costs of pollution, insofar as it constitutes what economists call a
104 negative externality. In its general form, uncoupled from the specific problem of pollution,
105 PPP can be taken to state the quite intuitive notion that the one who harms the environment or
106 public health, or stands in danger of doing so, should bear the costs of compensating for or
107 reducing that harm.⁵ Translated into the language of risk, it can be said to state the likewise
108 intuitive notion that the one who initiates the risk should bear the costs of precautions. Since
109 polluters are not the only relevant agents, we will call this principle Risk-Initiator Pays (RIP).

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⁵ Cf. also the ‘contribution to problem’ principle in the literature on climate justice (e.g., Neumayer 2000; Page 2008).

Principle	Abbreviation	Explanation
Risk-Initiator Pays	RIP	Those who initiate the activity that generates the risk should pay in proportion to their contribution to the risk
Ability to Pay	ATP	Those who are most able to afford it should pay
Beneficiary of Activity Pays	BAP	Those who benefit from the activity that generates the risk should pay
Beneficiary of Precaution Pays	BPP	Those who benefit from taking precautions against the activity that generates the risk should pay

118

119 **Table 1.** Four distributional principles used in our framework. A catch-all category, called ‘Others
 120 Pay’, is added to the framework in section 3 (see Figure 1).

121

122 A rationale for RIP is that the causal connection between the agent (the risk initiator)
 123 and the action (the risk imposed) gives a reason to place the burden of taking precautions on
 124 the one causing the risk rather than on someone who is not causally responsible. A further
 125 rationale can be found in desert-based views on just distribution. One prominent group of
 126 desert-based views emphasises the connection between desert and contribution (Miller 1976,
 127 1999; Riley 1989). Such views may be taken to imply that the costs of taking precautions
 128 should be distributed in a way that does not place greater burdens on people than they deserve
 129 for having contributed to the risk (Miller 2008).

130 The general plausibility of the desert view is perhaps best seen by looking at the
 131 implications of denying the moral importance of desert to just distributions. Consider the
 132 claim that it is of no moral importance whether, of two people performing some job, the one
 133 who contributes most to getting the job done receives at least an equal salary to the one who

134 contributes less. Even if welfare for some reason would be maximized by giving a greater
135 salary to the one who contributes less, it may still seem unfair to do so. A plausible reason for
136 this is that the one who contributes most does not deserve to get paid less than the one who
137 contributes least. On the contrary, it can be argued that she deserves a greater salary – at least
138 if she has also put a greater effort into getting the job done (Sadurski 1985; Milne 1986).

139 Similarly, desert can be a plausible ground for holding that someone contributing
140 negatively to the welfare of others, for instance by putting them at risk of serious harm, have a
141 greater obligation to reduce the risk or compensate for the harm than those contributing less to
142 the risk. For example, it is natural to suppose that countries that have historically contributed
143 greater amounts of greenhouse gas emissions to the atmosphere have a proportionately greater
144 obligation to bear the costs of climate change mitigation.⁶ In some cases, desert should
145 arguably be overridden by other concerns, such as ability to pay (see below). What is
146 important for now is that desert should be one consideration among others in distributing the
147 costs of precautions, and that it can provide a rationale for RIP in particular cases.

148 A second principle relevant to our context states that the burden of taking
149 precautionary measures ‘must be placed on those most able to afford it’ (Thompson and
150 Kennedy 1996). It resembles the principle of public finance called ‘ability to pay’, which
151 states that those who have the means should share more of the burden of public services.
152 Moreover, versions of this principle have been central to discussions about how costs related
153 to combatting climate change can be fairly distributed (e.g., Shue 1999; Neumayer 2000;
154 Caney 2005; Page 2008). In concordance with standard terminology in these discussions, we
155 call this principle Ability to Pay (ATP).

156 A central rationale behind ATP is that it is unfair to impose costs on poor individuals
157 or groups that are not able to afford them. In that light, it reflects considerations of justice

⁶ For discussions of ‘historical responsibility’ for climate change, see, e.g., Shue (1999), Neumayer (2000), Caney (2005), Page (2008).

158 directed at protecting the least advantaged. Several considerations of this sort can be found in
159 the literature. One prominent example is John Rawls's 'difference principle', which allows for
160 unequal distributions as long as they benefit the least advantaged. This principle is fair, Rawls
161 argues, because it is what reasonable people would choose for their social institutions in a
162 hypothetical 'original position', where a 'veil of ignorance' ensures that decision-makers have
163 no knowledge, at the time of deciding, of their own chances of finding themselves in the
164 worst off position (Rawls 1971).

165 Also, some welfare-based views, notably utilitarianism, stress maximizing welfare for
166 those least well off based on the thesis that each unit of a thing maximized will be marginally
167 less valuable the more one has of this thing (diminishing marginal utility). Hence, the
168 negative value of costs from taking precautions will be marginally less for those more able to
169 afford it. However, utilitarianism will only protect the least advantaged so long as this
170 maximizes overall utility. Distributing costs according to ATP could further be supported by
171 the 'priority view', which states that benefitting people matters more the worse off these
172 people are. On this basis, it is argued that we should prioritize the worst off even when this
173 does not maximize overall well-being (e.g., Arneson 2000). Finally, sufficientarians argue
174 that threshold values of welfare or 'contentment' exist that no individual should fall below
175 (Frankfurt 1987).⁷ This supports avoiding imposing costs that would push individuals or
176 groups below some acceptable threshold of welfare.

177 All these views have been heavily debated, and none of them prove that ATP should
178 be an overriding principle of fair distributions. Fortunately, that is not what we are after. What
179 is significant is that taken together they give substantial theoretical support to the weaker, but
180 for our purposes sufficiently strong claim that the concern for the worst off expressed by ATP

⁷ Cf. also the 'capabilities approach' as discussed for instance in Nussbaum and Sen (1993).

181 in the very least should be a serious moral consideration when distributing the costs of
182 precautions.

183 In some cases, RIP and ATP may coincide. For example, when considering how the
184 costs of climate change mitigation should be distributed on a global scale, it might be argued
185 that wealthier industrialized nations are both the primary risk initiators as well as the most
186 able to pay. However, RIP and ATP pull in opposite directions when those who initiate the
187 risk are less well off. Such tensions are illustrated by the cases discussed in section 4.
188 Consequently, an adequate framework for the just distribution of costs of precautions must be
189 able to address examples in which RIP and ATP suggest conflicting recommendations.

190 A third principle suggests that beneficiaries should bear costs of precautions (e.g.,
191 Goodin 2013; Goodin and Barry 2014; Lawford-Smith 2014). One recent interpretation of
192 this principle in the context of climate justice states that ‘being an innocent beneficiary of
193 significant harms inflicted by others may be sufficient to ground special duties to address the
194 hardships suffered by the victims, at least when it is impossible to extract compensation from
195 those who perpetrated the harm’ (Barry and Kirby 2017, 285). In order to separate
196 beneficiaries of the activity from beneficiaries of precautions (see below), we suggest a
197 principle called Beneficiary of Activity Pays (BAP). As we interpret it, BAP is more broadly
198 construed to cover beneficiaries that may or may not be ‘innocent’ as well as agents and
199 activities that have not produced actual harm but only a risk of harm.

200 Whether it is fair that beneficiaries pay in cases where risk-initiators or contributors to
201 the problem for some reason cannot pay – for instance because they no longer exist – have
202 been thoroughly examined in the literature on climate justice (e.g., Shue 1999; Neumayer
203 2000; Caney 2005; Page 2008). What to our knowledge is less discussed, is to what extent
204 positive contributions by risk-initiators to the welfare of others can give desert-based reasons
205 to invoke BAP, even when the risk-initiators still exist and could bear the costs of

206 precautions. It might be seen as fair in light of desert that the risk-initiator does not bear all
207 the costs of something that others also benefit from. That is, the positive contributions
208 stemming from the activity that introduces the risk might be a reason to reduce the burden on
209 the risk initiator to fully shoulder the costs of precautions.

210 A fourth principle can be formulated as stating that the ones who benefit from taking
211 precautions should pay the costs of taking them. We call it Beneficiary of Precaution Pays
212 (BPP). In the case of the green sea turtles discussed in section 4, BPP would imply that the
213 environmentalists and others who want to save the endangered turtles would benefit from
214 taking precautions and should therefore pay. Benefits of a precaution are not limited to
215 avoiding direct harm from the activity, as a precaution might have beneficial consequences of
216 its own, such as spurring economic or technological innovations. As in the case of BAP,
217 considerations of desert can support using Beneficiary of Precaution Pays (BPP). However,
218 we suggest in the next section that desert-based arguments for BPP are most plausible when
219 combined with some further consideration, for instance, that the precaution benefits relatively
220 well off people while imposing costs on those who have the least ability to pay.

221 Like RIP and ATP, BAP and BPP coincide in some cases, particularly, when
222 beneficiaries of the activity and the beneficiaries of the precaution are largely coextensive.
223 But the two principles diverge when some of those who would benefit from the precaution do
224 not also benefit from the activity, as illustrated by the cases discussed in section 4. Previous
225 discussions of fair distribution of costs of precautions have not explicitly distinguished BAP
226 and BPP, and consequently have not provided an account of how they should be balanced
227 against one another. Nor has previous literature explained how BAP and BPP should be used
228 in conjunction with RIP or ATP. Yet these principles can easily generate conflicting
229 recommendations, as those who benefit from the activity or the precaution need not be
230 identical to risk initiators and may not have the greatest ability to pay.

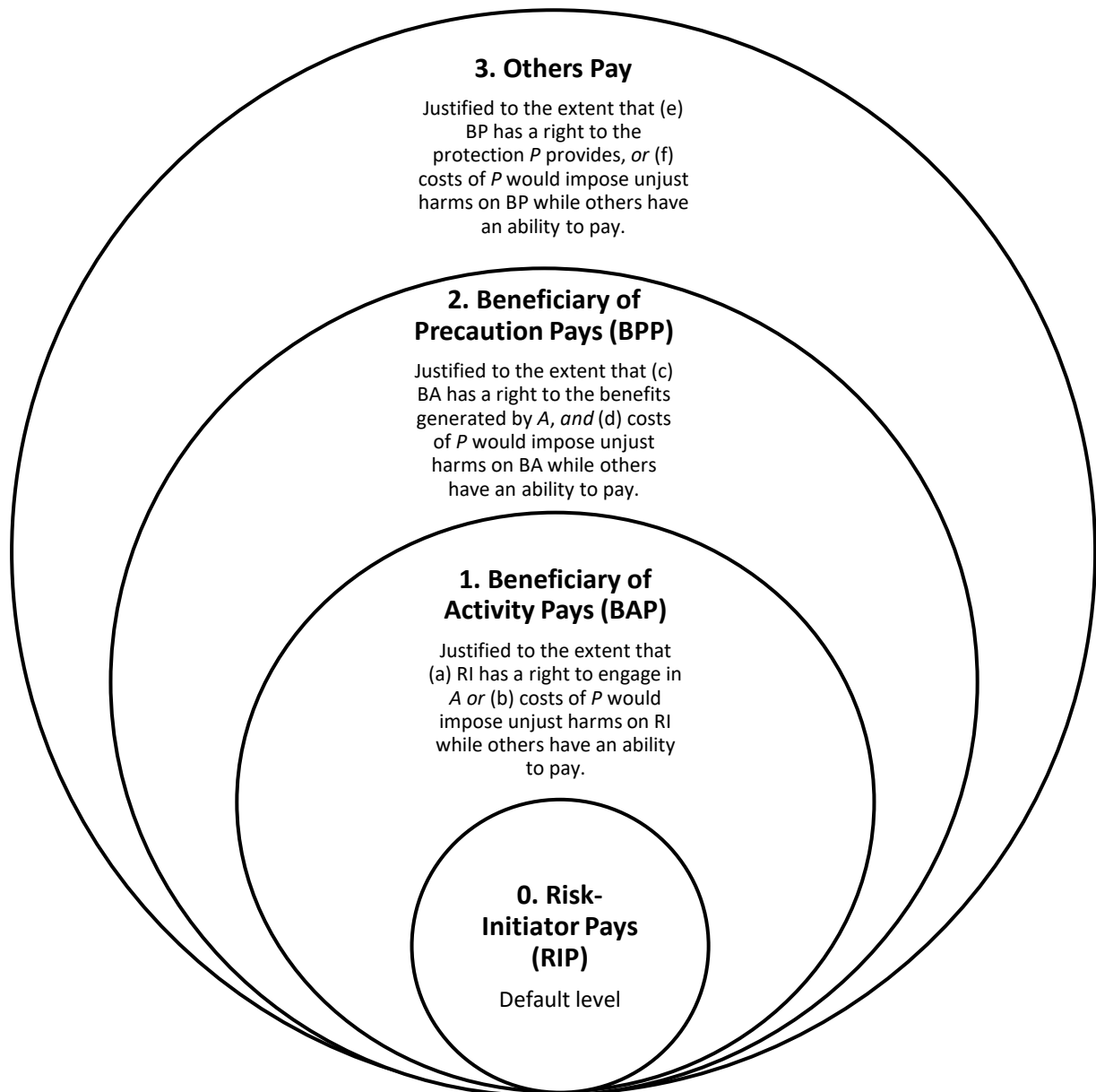
231 Considerations of rights add a further level of complexity. According to a conception
232 of rights developed by Robert Nozick, rights function as ‘side-constraints’ on the pursuit of a
233 just outcome (Nozick 2013). In our context, this implies that rights can constrain the use of
234 distributional principles. For instance, invoking RIP in the case of some activity can be
235 constrained by the risk-initiator’s right to engage in it, for example, because it is necessary for
236 survival. In cases in which initiators and beneficiaries of the risk largely overlap, such
237 circumstances may lead to a plausible argument that Beneficiary of Precaution Pays (BPP)
238 should be invoked. Conversely, the *lack* of a right of the risk initiator to engage in the activity
239 might strengthen the case for insisting upon RIP. And invoking ATP to make some
240 beneficiary of precautions *B* pay for a risk initiated by *A* may be constrained by the (*prima*
241 *facie*) right of *B* not to be exposed to risk by *A* without consenting to it (Hansson 2003). In
242 this context, the libertarian concept of entitlement might also be relevant. If some person *A*
243 who has a right to perform *x* is hindered by *B* in the performance of *x*, then *A* may be entitled
244 to some form of compensation (Nozick 2013, 57-84).

245 The complexity of the considerations examined in this section points to the need for a
246 systematic framework. To develop such a framework is the task of the following section.

247

248 **3. A framework for distributing precautionary costs**

249 Our framework consists of a sequence of defaults illustrated by nested circles that can be
250 expanded when there are strong reasons for sharing burdens (Figure 1). At the core is RIP,
251 with BAP as the next circle, BPP after that, and in the outer circle a general responsibility of
252 others who are not affected by the activity to shoulder the costs of precaution (‘others pay’).
253 In this framework, ATP and considerations of desert and rights function as reasons for
254 decisions about whether or not to broaden responsibility for sharing costs.



255

256 **Figure 1.** The figure can be used by decision-makers as a heuristic framework for analysing the
257 fairness of alternative distributions. An unjust harm involves a violation of rights or distributive or
258 procedural justice. Abbreviations: RI=risk-initiator; BA=beneficiary of activity; BP=beneficiary of
259 precaution; *A*=activity; *P*=precautionary measure.

260

261 Let's consider the rationale for this proposal, beginning with reasons for the role of
262 RIP as the default starting point. There are several pragmatic reasons for this choice. Making
263 the risk-initiator the default bearer of the cost of precautions provides a built-in incentive to

264 avoid activities that unnecessarily impose risks on others. When faced with the prospect of
265 paying the cost of a precaution, the risk initiator has an incentive to ask if the risk is worth
266 taking at all, or if the activity can be modified to mitigate that risk (e.g., through a redesign of
267 production processes that avoids reliance on a hazardous material). In such circumstances, the
268 risk-initiator will proceed with the activity only if there is some benefit, such as profit, to be
269 gained from it that exceeds the costs of precautions. In addition, the risk-initiator is often in
270 the best position to carry out precautions and to do so in a timely manner.

271 Treating RIP as a default can also be supported by reflections on the ethics of risk
272 impositions. The special responsibility of the risk initiator to reduce the risk when required is
273 related to the fact that the risk is *imposed* on someone by the risk initiator. Now, if the risk
274 does not materialize, then no one is actually harmed by the activity. But that does not mean
275 that no harm is done. Being at risk can itself be harmful (Nozick 2013, 66–69; Hayenhjelm
276 and Wolff 2012). Furthermore, a belief on the part of others that you are at risk may also
277 entail substantial harms, because it may affect others' behaviour towards you in ways that
278 negatively impact your welfare. For example, the economic value of your property may be
279 significantly diminished if others believe it is at risk of toxic contamination from a nearby
280 chemical factory.

281 Consideration of other principles of distributive justice discussed in section 2 reinforce
282 the role of RIP as the default, and they also help to guide decisions about how costs should be
283 distributed as one expands the circle. Let us explore this systematically by considering two
284 types of cases separately. In the first case, the risk initiators and the beneficiaries of the
285 activity are coextensive, and in the second some beneficiaries of the activity are not risk
286 initiators. To illustrate the first case, consider a person who performs chemical experiments
287 involving explosive materials in his basement as a hobby, thereby imposing risks on his
288 neighbours. The neighbours make no contribution to the risk, and do not benefit from it, while

289 the risk initiator—the would-be chemist—benefits by being able to engage in an activity he
290 enjoys.

291 Requiring that the cost of precautions (e.g., transforming the would-be chemist's
292 basement into a chemical laboratory with all of the required safety apparatus) be borne by the
293 neighbours, then, would be an instance of BPP. There are several reasons against making the
294 beneficiary of the precaution pay in this case. Dangerous chemical experiments are not
295 something one has a right to undertake in a private residence. Furthermore, making the
296 neighbours pay would be unjustified from a desert perspective, since the chemistry
297 experiments make no contribution to the wellbeing of the neighbours. Thus, while bearing the
298 cost of precautions may be harm for the would-be chemist, there is no plausible argument that
299 it is an *unjust* harm (as defined in Figure 1).

300 In cases where the beneficiary of the activity is not identical to the risk initiator,
301 arguments that others besides the risk initiator should contribute to paying costs of precaution
302 can be supported by considerations of just deserts. For example, consider a chemical industry
303 that is the largest employer in a region wherein everyone benefits economically from the
304 industry to varying degrees. In this case, there is a stronger argument from desert that others
305 besides the risk initiator should share the costs of precautions. Given the economic
306 contributions of the chemical industry in this example, there is a plausible argument that it
307 would be unjust for industry to be the sole bearer of costs of precautions (i.e., an 'unjust
308 harm' in the sense of Figure 1). Thus, funds for agencies that regulate the chemical industry
309 could be supported by taxes from the general public as well as taxes on industry. Of course, to
310 what extent the chemical industry deserves social support in bearing the costs of precautions
311 depends, inter alia, on how equitably the economic benefits are distributed. If these are highly
312 concentrated in a small capitalist class, then both desert and ATP suggest that industry should
313 bear the bulk of the costs. To the extent that benefits are distributed more equally, the risk

314 initiator has a stronger moral basis for claiming that other beneficiaries of the activity should
315 also pay.

316 As displayed in Figure 1, we suggest that the next steps after RIP are BAP and then
317 BPP. Why should the beneficiary of the activity have a greater obligation to pay for
318 precautions than the beneficiary of precautions? Take, again, the example of the chemical
319 factories that are the largest employer in a region. As before, the chemical factories and their
320 owners are the risk-initiators and all inhabitants of the region benefit from its economic
321 output, either directly or indirectly. However, suppose that there are, in addition, other regions
322 or countries that enjoy little or no gain from the chemical factories but suffer from their
323 adverse environmental effects, for instance, in the form of pollution to air or water. In this
324 case, some beneficiaries of the precaution are not also beneficiaries of the activity. A natural
325 intuition here is that the default should be that the beneficiaries of the activity should pay
326 before those who only benefit from the precaution. Why?

327 One plausible reason is that the risk initiator can give, subject to qualifications noted
328 above, desert-based reasons to other beneficiaries of the activity that they should shoulder part
329 of the burden of the precautions. But the risk initiator can give no such reason to people in
330 other states or regions that are subject to the risks of the activity but do not enjoy its benefits.
331 Moreover, pragmatic reasons similar to the case of RIP apply here as well. If BAP kicks in
332 before BPP, then the beneficiaries of the activity must consider whether its social benefits are
333 worth the costs of precautions. This may prompt them to reconsider engaging in the activity,
334 or to explore ways in which the activity can continue but with mitigated risks. In contrast,
335 placing BPP before BAP in the circle would encourage risk impositions that are not justified
336 by their social benefits.

337 Nevertheless, in some cases there may be legitimate reasons for invoking BPP.
338 Consider two cases: the first in which the beneficiaries of the activity and the beneficiaries of

339 the precaution are coextensive, and the second in which they are not. In the first case, if BAP
340 is applicable (e.g., for reasons of desert), then so too is BPP. (One might ask whether there
341 might be others who should pay, such as the international community, but we delay this
342 question until later.) In the second case, can there be grounds for insisting that those who
343 benefit from the precaution but not the activity should contribute to costs of the precaution?
344 Here rights to engage in the activity and ATP are relevant. In general, if those who benefit
345 from the activity have a right to those benefits (e.g., because they are necessary for survival)
346 but are unable to bear the costs of precautions, then there may be grounds for invoking BPP.
347 The turtle fishing example discussed in section 4 illustrates this pattern.

348 The final ring in Figure 1 is ‘others pay,’ in which responsibility for costs of
349 precaution is borne, at least partially, by those not at risk from the activity nor involved as
350 initiators or beneficiaries. In our framework, ‘others pay’ is considered last. But why should
351 we place BPP before those who are unaffected by the activity in the distribution circle? We
352 suggest that this is plausible for desert-based reasons. Those carrying out the precaution can
353 claim to the beneficiary of precaution that they are making some contribution to their welfare
354 (i.e., by mitigating a risk). However, they cannot make similar claims to those unaffected by
355 the action. From a related pragmatic perspective, those with a stake in the enacting the
356 precaution have an incentive to support it that is not possessed by those who are not impacted
357 by the activity.

358 To illustrate grounds for invoking ‘others pay,’ consider a case in which the risk
359 initiators, beneficiary of the activity, and beneficiary of the precaution all consist of the same
360 group. Suppose that the activity generates severe health risks, but is also a necessity of life
361 and that the people involved are not able to afford a safer alternative. A possible example here
362 might be burning organic materials such as dung for cooking and heating inside homes. In
363 such a case, basic rights of sustenance and health support taking precautions (e.g., the

364 introduction of cleaner fuels), but it may be that only those unaffected by the activity are able
365 to pay for them.

366 Finally, we would like to note one type of consideration that has not been explicitly
367 mentioned so far, namely, the existence of historical and systemic wrongs, such as
368 colonialism or racial discrimination. Such considerations can enter in our framework in
369 several ways, for instance, by supporting the rights of certain groups to the protections
370 provided by the precaution or to engage in certain culturally significant practices that may
371 generate some environmental risk. Thus, a complex set of historical, social, or economic
372 considerations may be involved in judgments about rights to engage in an activity or as
373 reasons for why bearing the costs of a precaution would constitute an unjust harm for some
374 but not others.

375

376 **4. Cases**

377 In the following we present two cases showing how the framework can be applied. Case 1 is
378 based on a study by Roland Castro on green sea turtle fishing in Costa Rica (Castro 2005). It
379 illustrates how expanding the circle from RIP to BPP can be justified according to our
380 framework. Case 2, about the prospect of deep sea mining in Papua New Guinea, illustrates a
381 case where there are strong reasons to remain at the default level of RIP.

382

383 Case 1: Green sea turtles in Costa Rica

384 Because of their strategic location in the Central American isthmus, Costa Rican shores host
385 nesting populations of five of the seven existing species of sea turtle. The green sea turtle
386 (*Chelonia mydas*) has traditionally been hunted by Caribbeans for eggs, fat and meat. As a
387 consequence of the hunting, the turtle population is believed to have come close to extinction
388 in the 1960s, when some estimate that nearly every female turtle arriving to nest in the area

389 which is now known as the Tortuguero National Park was captured to make turtle soup for the
390 export market, and for meat and eggs for the local market (Castro 2005).⁸ As a measure
391 against this, the Costa Rican Government enacted a regulation in 1982 officially establishing
392 a quota of 1800 for the annual capture of green sea turtles, as well as requiring that butchering
393 only take place in state-regulated slaughter houses and their meat sold only within the
394 country. As a consequence, the permitted level of harvest was significantly reduced.
395 However, by the late 1990s high rates of poaching meant that the number of turtles killed
396 were many times higher than the legal limit, thereby putting unacceptable pressure on the
397 already fragile population.⁹

398 In light of this, sea turtle conservation groups, environmental non-governmental
399 organizations and some ecotourism hotels from Tortuguero requested INCOPECA – the
400 Costa Rican Fisheries Authority (Instituto Costarricense de Pesca y Acuicultura) – to amend
401 this regulation and prohibit all hunting of green turtles. This attempt being unsuccessful, the
402 groups filed a lawsuit in May of 1998 to challenge the regulation before the Constitutional
403 Court, a branch of the Costa Rican Supreme Court.

404 In the light of uncertainty about how the hunting regime under INCOPECA was
405 affecting the ecological equilibrium of the species, the petitioners invoked the precautionary
406 principle and asked the Court to annul the regulation to prevent the extinction of the green sea
407 turtles, emphasizing that the species was considered endangered and threatened by extinction.
408 INCOPECA on their part claimed that they did all they could to prevent such extinction
409 through implementation of the regulation. Their defence was based on the argument that the
410 that no scientific evidence was available that that could prove that the species was facing
411 extinction under the current regime (exactly the type argument that the precautionary
412 principle is supposed to counter).

⁸ The green sea turtle is currently listed as an endangered species in the IUCN Red List of Threatened Species, available at <http://www.iucnredlist.org/> (accessed 14.09.2017).

⁹ On the fragility of the turtle population, see AIDA (2004).

413 The General Attorney's Office and the *Amicus Curioae* presented by the Costa Rican
414 Ombudsman supported the petitioners' case. The Ombudsman invoked the precautionary
415 principle against the regulation permitting turtle hunting (AIDA 2004). The Constitutional
416 Court issued its decision on February 19, 1999, ruling in favour of the regulation being
417 annulled. Subsequently, INCOPECA published a resolution stating that hunting and
418 commerce of the green sea turtle were prohibited, thereby officially ending the practise.

419 From a socioeconomic perspective, the ban on harvesting has had its winners and
420 losers. While the villagers in Tortuguero in the end can be said to have gained economically
421 from the prohibition, because of the positive effects it had on tourism (Troëng, Chamorro and
422 Silman 2002), the fishermen who lost out were mostly from the Port of Limón (Castro 2005).
423 Not benefitting to any significant extent from the tourism in Tortuguero, these fishermen
424 seemingly lost their livelihood without compensation.

425 Let us now look at how this process can be analysed and evaluated according to our
426 framework. For the most part, the risk-initiators – being in this case turtle fishermen – have
427 been compensated for the burdens (consisting mostly of opportunity costs and costs from
428 retraining to new professions) of taking precautions in this case, through programmes and
429 initiatives by the Caribbean Conservation Corporation (CCC) and the National Park Service.
430 Both these organisations could be categorized as beneficiaries of precautions according to our
431 framework. The beneficiaries of the activity (turtle fishing) are mostly coextensive with the
432 risk-initiators, so that the question in this case is whether to expand the circle to BPP.
433 According to our framework, there are two main reasons for doing so. The first is that taking
434 away the fishermen's livelihood may be viewed as a violation of their basic right of
435 subsistence (Shue 1996). Second, ATP gives us a reason to widen the circle, since presumably
436 organisations such as CCC and the National Park Service have a greater 'ability to pay' than
437 local fishermen and villagers. It could further be argued that taking away the livelihood of the

438 fishermen would risk pushing them below an acceptable standard of living – e.g., beneath the
439 poverty line as defined by the World Bank – which implies that ATP can be invoked on
440 sufficientarian grounds. Thus, there is a case to be made that banning sea turtle fishing
441 without any form of compensation for the fishermen would have been an unjust harm.

442 Finally, it could be asked whether the former turtle fishermen of Port of Limón, who
443 did not benefit from the thriving tourist industry in Tortuguero, should not also have received
444 some form of compensation for the burdens they had to bear from the precautionary ban on
445 turtle fishing. This could be argued on egalitarian grounds, in particular if it cannot be showed
446 that these fishermen, presumably being the worse off group, benefit from the inequality
447 between themselves and the Tortuguero fishermen (cf. the difference principle). Their right to
448 subsistence may be said to have been violated in the same manner as the right of the
449 Tortuguerans. If there is no reason to discriminate other than that of the geographical location,
450 this may be a reason for compensating them, perhaps by redistributing some of the benefits
451 gained from tourism or helping them take part in the tourist industry.

452

453 Case 2: Deep sea mining in Papua New Guinea

454 Deep sea mining involves retrieving minerals such as copper, gold, silver and zinc from the
455 ocean floor at great depths. Several authors have recommended a precautionary approach to
456 deep sea mining, which to date has never been carried out on a commercial scale (Halfar and
457 Fujita 2002; Wedding et al. 2015); Mengerink et al. 2014). In the following we discuss the
458 Solwara 1 mining project proposed by Nautilus Minerals Inc. in the Bismarck Sea, off the
459 coast of Papua New Guinea (PNG).¹⁰

¹⁰ The precautionary principle is recommended applied in the PNG case by Birney (2006).

460 The onshore and offshore components of Solwara 1 would be in the provinces of East
461 New Britain and New Ireland. Rosenbaum (2011)¹¹ argues that communities in both
462 provinces will face ‘a range of significant risks related to the project’ (Rosenbaum 2011, 22).
463 The Bismarck Sea underpins local culture and provides food and economic livelihoods for
464 surrounding coastal communities. Further research is needed to determine the effects of the
465 Solwara 1 project on subsistence fishing around the Bismarck Sea and family livelihoods.
466 However, according to Rosenbaum the environmental impacts described in Nautilus’s own
467 Environmental Impact Statement (EIS) (Nautilus Minerals 2008) indicates that Solwara 1 has
468 the potential to ‘erode the long term economic base of local communities’ (Rosenbaum 2011,
469 22).¹² There is also a possibility that mining activities may exacerbate social problems already
470 faced by island communities, as acknowledged by Nautilus in their EIS (Nautilus Minerals
471 2008). Moreover, it is possible that the project may affect spiritual connections between local
472 communities and the marine environment (Rosenbaum 2011). Finally, Rosenbaum argues that
473 National tuna fisheries may also be affected by the Solwara 1 mine, potentially creating health
474 risks for people living in the villages and towns in the vicinity of the Bismarck Sea.

475 Nautilus and the Government of PNG argue that Solwara 1 will bring significant
476 benefits to PNG. The Nautilus EIS states that the project will probably generate revenues in
477 excess of US\$1 billion, as well as 140 jobs. However, total tax, duties and royalty payments
478 to the Government of PNG are estimated at only US\$40.8 million over the nominal life of the
479 project (Nautilus Minerals 2008, 10-4). Furthermore, the community development fund to be
480 established by Nautilus to support local health and education projects represents a relatively
481 small proportion of the revenues. Nautilus will contribute two kina for every tonne of ore

¹¹ The description in the current paper of potential socio-economic impacts of the Solwara 1 project is based mainly on Rosenbaum (2011), which was published with support from MiningWatch Canada, CELCoR (The Centre for Environmental Law and Community Rights Papua New Guinea), Oxfam Australia, and The Packard Foundation. Rosenbaum is affiliated with the Deep Sea Mining Campaign. See <http://www.deepseaminingoutofourdepth.org/> (accessed 20.04.2017). For further discussion, see Sing 2015; Filer and Gabriel (forthcoming).

¹² For a report on risks and uncertainties associated with deep sea mining, see ECORYS Nederland BV (2014).

482 mined, providing around PGK5.8 million (about US\$1.8 million) over the project life
483 (Nautilus Minerals 2008, 10-5).

484 The Government of PNG has reserved the right to a 15% joint venture partnership in
485 the Solwara 1 project.¹³ While such an arrangement may secure a greater revenue stream for
486 the Government, Rosenbaum argues that it ‘would represent a gross conflict of interest that
487 would compromise the PNG Government’s capacity to regulate the mining activity’
488 (Rosenbaum 2011, 25). Moreover, she argues, experience demonstrates that ‘the lack of good
489 governance and accountability means that revenues accrued by the Government of Papua
490 New Guinea may not necessarily translate into benefits for citizens’ (Rosenbaum 2011, 25).

491 The socio-economic impacts described here are of crucial importance to the evaluation
492 of the distributional consequences of taking precautions in the Solwara 1 case. Importantly, if
493 it is correct that revenues accrued by the Government of Papua New Guinea are unlikely to
494 translate into benefits for citizens, then this is a reason to say that the Government of PNG
495 should be separated from the general populace at the levels of RIP, BAP and BPP in our
496 framework. It also provides reason to believe that the ability to pay of the citizens of PNG
497 does not reflect the ability to pay of the Government of PNG.

498 This suggests that there is no need in this case to go beyond the default stage of RIP. It
499 may, as indicated, be argued that both the PNG Government and Nautilus are risk-initiators.
500 Does this not trigger ATP on the behalf of PNG, which according to UNDP is a lower to
501 middle income country?¹⁴ ATP is as we have seen aimed at protecting those who are worst
502 off from having to take on burdens that would make them even worse off. The worst off in
503 this case must be said to be the people of PNG. Since the people of PNG are not (relevantly)
504 identical to the Government of PNG in this case, ATP does not warrant expanding the circle

¹³ <http://www.deepseaminingoutofourdepth.org/3366/> (accessed 20.04.2017).

¹⁴ United Nations Development Program (UNDP) ranks PNG as a lower to middle income country with a gross national per capita income of US\$2,386. See http://www.pg.undp.org/content/papua_new_guinea/en/home/countryinfo.html (accessed 27.03.2017).

505 due to the distributional consequences for those worst off. Finally, there seems to be no
506 relevant rights to be claimed from the side of the risk-initiators. Rather, citizens may have
507 their right to subsistence threatened by the mining project.

508 How the burden should be shared between the Government of PNG and Nautilus
509 would presumably be a matter of negotiation. At first glance it does not seem entirely
510 unreasonable that the PNG Government takes its fair share. However, if this affects the
511 citizens of PNG, then ATP and doubts about whether the citizens of PNG will benefit on
512 balance from mining will suggest that they should not pay for precautions.

513

514 **6. Conclusion**

515 The aim of this paper has been to develop a framework that can aid decisions about how to
516 distribute costs of taking precautions against environmental threats. The framework can be
517 used in situations where the precautionary principle is applied. Moreover, it can be used to
518 address distributional issues arising from taking precautions in the more general sense
519 referred to in the introduction, for instance in cases where a cost-benefit approach is applied.
520 If a cost-benefit analysis reaches the conclusion that costly measures should be taken against
521 some risk, then – as when applying the precautionary principle – the ethical question arises of
522 how the costs should be distributed. Our framework can be used to analyse the fairness of
523 alternative distributions.

524 It should be noted that there are some general problems of distribution that are not
525 discussed in our paper. A well-known problem is the so-called index problem, which arises
526 from the difficulty of *measuring* the costs (and benefits) to be distributed (Lamont and Favor
527 2016). This problem is less pertinent in cases where what is to be distributed are economic
528 costs, since the measurement problem arises first and foremost because of a difficulty in
529 finding a common value measure, or in commensurating values of different qualities. Another

530 problem arises from difficulties in defining the right time frame for the distribution, and in
531 comparing time frames (future vs. present costs, for instance) (Lamont and Favor 2016).
532 Moreover, the so-called non-identity problem can make it difficult to evaluate costs of
533 precautions with regard to future generations (Parfit 1982, 1984),¹⁵ and the notion of
534 historical responsibility poses a challenge with regard to risks initiated by individuals or
535 groups in the past (e.g., Page 2008). While such problems do not preclude equitably
536 distributing costs of precautions, they are serious theoretical problems – with potentially
537 serious practical implications – that decision-makers should be aware of and that call for
538 further research.

539

540

Literature

541

- 542 AIDA (2004). ‘Costa Rica Turtles.’ Interamerican Association for Environmental Defense.
543 <http://www.aida-americas.org/aida.php?page=70&lang=en>.
- 544 Arneson, Richard (2000). ‘Luck Egalitarianism and Prioritarianism.’ *Ethics*. 110 (2): 339–
545 349.
- 546 Banks, Glenn (1993). ‘Mining Multinationals and Developing Countries: Theory and Practice
547 in Papua New Guinea.’ *Applied Geography* 13, no. 4 (1993/10/01): 313-27.
- 548 Barry, Christian, and Robert Kirby (2017). ‘Scepticism About Beneficiary Pays: A Critique.’
549 *Journal of Applied Philosophy* 34, no. 3 (2017): 285-300.
- 550 Birney, Kristi, Amber Griffin, Jonathan Gwiazda, Johnny Kefauver, Takehiko Nagai, and
551 Douglas Varchol (2006). ‘Potential Deep-Sea Mining of Seafloor Massive Sulfides: A
552 Case Study in Papua New Guinea.’ *Donald Bren School of Environmental Science
553 and Management Thesis*.
- 554 Caney, Simon (2005). ‘Cosmopolitan Justice, Responsibility, and Global Climate Change.’
555 *Leiden journal of international law* 18, no. 4 (2005): 747-75.
- 556 Caribbean Conservation Corporation (1999). ‘Lawsuit Victory Halts Legal Killing of Green
557 Sea Turtles in Costa Rica.’ news release, 11 March 1999.
- 558 Castro, Roland (2005). ‘Protection of Sea Turtles: Putting the Precautionary Principle into
559 Practice.’ Chap. 7 In *Biodiversity and the Precautionary Principle: Risk and
560 Uncertainty in Conservation and Sustainable Use*, edited by Rosie Cooney and
561 Barney Dickson. London: Earthscan.
- 562 Dickson, Barney (2005). ‘Fairness and the Costs and Benefits of Precautionary Action.’ In
563 *Biodiversity and the Precautionary Principle: Risk and Uncertainty in Conservation*

¹⁵ Derek Parfit, ‘Future Generations: Further Problems,’ *Philosophy & Public Affairs* (1982); *Reasons and Persons* (Oxford: Oxford University Press, 1984);

- 564 *and Sustainable Use*, edited by Barney and Rosie Cooney Dickson. London:
565 Earthscan.
- 566 ECORYS Nederland BV (2014). ‘Study to Investigate State of Knowledge of Deep Sea
567 Mining. Final Report Annex 6 Environmental Analysis.’
- 568 Filer, Colin, and Jennifer Gabriel (1987). ‘How Could Nautilus Minerals Get a Social Licence
569 to Operate the World's First Deep Sea Mine?’. *Marine Policy* (forthcoming).
- 570 Frankfurt, Harry. ‘Equality as a Moral Ideal.’ *Ethics* 98, no. 1 (1987): 21-43.
- 571 Gaines, Sanford E (1991). ‘The Polluter-Pays Principle: From Economic Equity to
572 Environmental Ethos.’ *Tex. Int'l LJ* 26 (1991): 463.
- 573 Goodin, Robert E (2013). ‘Disgorging the Fruits of Historical Wrongdoing.’ *American
574 Political Science Review* (2013): 478-91.
- 575 Goodin, Robert E, and Christian Barry. ‘Benefiting from the Wrongdoing of Others.’ *Journal
576 of Applied Philosophy* 31, no. 4 (2014): 363-76.
- 577 Halfar, J., and R.M. Fujita (2002). ‘Precautionary Management of Deep Sea Mining.’ *Marine
578 Policy*, no. 26 (2002): 103–06.
- 579 Hansson, Sven Ove (2003). ‘Ethical Criteria of Risk Acceptance.’ *Erkenntnis* 59, no. 3
580 (2003): 291-309.
- 581 Hayenhjelm, Madeleine, and Jonathan Wolff (2012). ‘The Moral Problem of Risk
582 Impositions: A Survey of the Literature.’ *European Journal of Philosophy* 20 (2012):
583 E26-E51.
- 584 IUCN (2004). ‘2004 Iucn Red List of Threatened Species’. IUCN Species Survival
585 Commission. Available at <http://www.redlist.org/>.
- 586 Jobstvogt, Niels, Nick Hanley, Stephen Hynes, Jasper Kenter, and Ursula Witte (2014).
587 ‘Twenty Thousand Sterling under the Sea: Estimating the Value of Protecting Deep-
588 Sea Biodiversity.’ *Ecological Economics* 97 (2014): 10-19.
- 589 Lamont, Julian and Christi Favor (2016). ‘Distributive Justice.’ *The Stanford Encyclopedia of
590 Philosophy* Winter 2016 Edition, URL =
591 <<https://plato.stanford.edu/archives/win2016/entries/justice-distributive/>>.
- 592 Lawford-Smith, Holly (2014). ‘Benefiting from Failures to Address Climate Change.’
593 *Journal of Applied Philosophy* 31, no. 4 (2014): 392-404.
- 594 Mengerink, Kathryn J, Cindy L Van Dover, Jeff Ardron, Maria Baker, Elva Escobar-Briones,
595 Kristina Gjerde, J Anthony Koslow, *et al* (2014). ‘A Call for Deep-Ocean
596 Stewardship.’ *Science* 344, no. 6185 (2014): 696-98.
- 597 Miller, David (1999). *Principles of Social Justice*. Harvard University Press.
598 ——— (1976). *Social Justice*. Oxford: Oxford University Press.
599 ——— (2008). ‘Global Justice and Climate Change: How Should Responsibilities Be
600 Distributed?’, *Tanner Lectures*, delivered at Tsinghua University Beijing. March 24–25,
601 2008.
- 602 Milne, Heather (1986). “Desert, effort and equality,” *Journal of Applied Philosophy*, 3: 235–
603 243.
- 604 Nautilus Minerals (2008). ‘Environmental Impact Statement. Nautilus Minerals Niugini
605 Limited. Solwara 1 Project.’
606 <http://www.nautilusminerals.com/irm/content/pdf/environment-reports/Environmental>
607 [Impact Statement - Main Report.pdf](http://www.nautilusminerals.com/irm/content/pdf/environment-reports/Environmental).
- 608 Neumayer, Eric (2000). ‘In Defence of Historical Accountability for Greenhouse Gas
609 Emissions.’ *Ecological economics* 33, no. 2 (2000): 185-92.
- 610 Nozick, Robert (2013). *Anarchy, State, and Utopia*. New York: Basic books, 2013.
- 611 Nussbaum, Martha, and Amartya Sen (1993). *The Quality of Life*. Oxford University Press.
- 612 O’Riordan, Timothy (1994). *Interpreting the Precautionary Principle*. Vol. 2: Earthscan.

- 613 OECD (1972). 'Guiding Principles Concerning International Economic Aspects of
614 Environmental Policies, Recommendation C(72)128, Adopted May 26, 1972,
615 Reprinted in 11 I.L.M. 1172 (1972).'
- 616 Parfit, Derek (1982). 'Future Generations: Further Problems.' *Philosophy & Public Affairs*
617 (1982): 113-72.
- 618 ——— (1984). *Reasons and Persons*. Oxford: Oxford University Press.
- 619 Page, Edward A (2008). 'Distributing the Burdens of Climate Change.' *Environmental*
620 *Politics* 17, no. 4 (2008): 556-75.
- 621 Rawls, John (1971). *A Theory of Justice*. Harvard University Press. 1971.
- 622 Riley, Jonathan (1989). 'Justice under Capitalism.' *Nomos* 31 (1989): 122-62.
- 623 Rosenbaum, Helen (2011). *Out of Our Depth: Mining the Ocean Floor in Papua New*
624 *Guinea*. MiningWatch Canada.
- 625 Sadurski, Wojciech (1985). *Giving desert its due: social justice and legal theory* (Law and
626 Philosophy Library, Volume 2), Dordrecht, Boston: D. Reidel.
- 627 Sen, Amartya (2011). *The Idea of Justice*. Harvard University Press.
- 628 Shue, Henry (1996). *Basic Rights: Subsistence, Affluence, and Us Foreign Policy*. Princeton
629 University Press.
- 630 ——— (1999). 'Global Environment and International Inequality.' *International affairs* 75,
631 no. 3 (1999): 531-45.
- 632 Sing, Jason (2015). 'Regulating Mining Resource Investments Towards Sustainable
633 Development: The Case of Papua New Guinea.' *The Extractive Industries and Society*
634 2, no. 1 (1/2015): 124-31.
- 635 Steel, Daniel (2015). *Philosophy and the Precautionary Principle: Science, Evidence, and*
636 *Environmental Policy*. Cambridge: Cambridge University Press.
- 637 Thompson, Herb, and Deborah Kennedy (1996). 'Ecological-Economics of Biodiversity and
638 Tropical Rainforest Deforestation.' *Journal of Interdisciplinary Economics* 7, no. 3
639 (1996): 169-90.
- 640 Troëng, S, E Chamorro, and R Silman (2002). 'Ban and Benefits: Tortuguero at 2000.' Paper
641 presented at the Proceedings of the Twentieth Annual Symposium on Sea Turtle
642 Biology and Conservation. US Dep. Commer. NOAA Tech. Memo. NMFS-SEFSC-
643 477.
- 644 Trouwborst, Arie (2006). *Precautionary Rights and Duties of States*. Nova Et Vetera Iuris
645 Gentium. Leiden: Martinus Nijhoff Publishers.
- 646 Valentini, Laura (2012). 'Ideal vs. Non-ideal Theory: A Conceptual Map,' *Philosophy*
647 *Compass* 7/9 (2012): 654–664.
- 648 Wedding, LM, SM Reiter, CR Smith, KM Gjerde, JN Kittinger, AM Friedlander, SD Gaines,
649 *et al.* (2015). 'Managing Mining of the Deep Seabed.' *Science* 349, no. 6244 (2015):
650 144-45.
- 651 World Bank (2016). 'Precautionary Management of Deep Sea Mining Potential in Pacific
652 Island Countries.' Washington (DC).
- 653

654

655