

1 **IS THE B.C. FORESTRY SLASH-BURNING POLICY**
2 **A CRIME AGAINST HUMANITY?**

3
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5

6
7 The Question

8
9 During September and October of 2015, massive and unusual volumes of smoke drifted
10 from certain parts of Indonesia across the Malay Peninsula, including Singapore and
11 Kuala Lumpur, as well as densely populated regions of Indonesia itself. The smoke
12 originated in extensive fires set to burn agricultural residue and slash from forest
13 clearance, but also from accidentally ignited peat fires. According to a Harvard-led team
14 of researchers, the smoke resulted in 100,000 excess deaths across Indonesia, Malaysia,
15 and Singapore. At the time, a spokesperson for the Indonesian Meteorology,
16 Climatology and Geophysics Agency was quoted as saying “This is a crime against
17 humanity of extraordinary proportions.”

18
19 Is the burning of gigantic quantities of forestry slash a crime against humanity? If it is
20 not a crime against humanity in the technical sense, does a government policy of
21 mandating the burning of huge quantities of forestry slash fit into international law as a
22 crime as serious as a “crime against humanity?” And if a policy of mandating slash
23 burning does meet the requirements of criminal prosecution under international law, does
24 it make sense to view forestry slash burning policy in British Columbia as criminal in
25 nature?
26

27 Quantities of slash burned in B.C.; and the scale of greenhouse gas emissions

28

29 “Slash,” for those readers not acquainted with the term, broadly refers to whatever dead
30 and disturbed organic materials are left in a logging cutblock after the merchantable
31 timber has been hauled away. These materials include treetops, branches, needles or
32 leaves of other sort, stumps and roots, trees too small or of the wrong size to be milled,
33 deadfall, incidentally destroyed bushes and herbs, and even some organic soil. Removal
34 of slash from forestry operations is mandated by the B.C. Wildfire Act and the Wildfire
35 Regulation, for which the Minister Responsible is the Minister of Forests, Lands and
36 Natural Resource Operations.

37

38 The quantities of logging slash produced in British Columbia boggle the imagination. In
39 2017, for example, timber operators in the Bulkley and Lakes District Timber Supply
40 Areas (TSAs) issued notices for the burning of 27,332 nominal slash “piles.”

41 Government and industry documents state that the slash from one hectare of clearcut is
42 considered to be equivalent to two slash “piles,” no matter what the actual size or number
43 of slash piles. By the most conservative estimates, each slash “pile” has a mass of 25
44 tonnes. Therefore in 2017 the Bulkley and Lakes District TSAs burnt something like
45 $27,332 \times 25 \times 2 = 1,366,000$ tonnes of slash.

46

47 But there are 37 TSAs in British Columbia. Whereas about 50,000 ha or 500 square
48 kilometres were logged in the Bulkley and Lakes District TSAs in 2017, in B.C. as a
49 whole, about 193,000 hectares year are logged in “public” forests and a further 9,000

50 hectares a year on privately managed forest land. So the total amount of slash generated
51 in B.C., by a highly conservative estimate, would be over $200,000 \times 25 \times 2 = 10,000,000$
52 tonnes. Some slash is diverted to the environmentally questionable practice of
53 manufacturing of wood pellets, exported for heating, but most of the feedstock going into
54 pellet plants is composed of sawmilling scraps and waste wood, sawdust, and planer
55 shavings. Except for trees killed by Mountain Pine Beetle – a temporarily available
56 supply – it is uneconomical to haul slash from the cutblocks out to the plants.

57
58 Overwhelmingly, slash in British Columbia is just burned. When it is burned, it releases
59 about 1.9 times the weight of wood in it as carbon dioxide, the principal greenhouse gas
60 promising to raise world atmospheric temperatures by over 2 degrees Celsius by the end
61 of this century, if not a great deal more. Consequently, at a first estimate, the burning of
62 logging slash in B.C. releases close to 20,000,000 tonnes of carbon dioxide per year, not
63 to mention substantial quantities of much more potent greenhouse gases, such as methane
64 and nitrogen dioxide.

65
66 Furthermore, the nominal figure of 50 tonnes of slash per hectare may understate the
67 actual amount of slash by as much as 100%. Studies which have actually weighed the
68 amount of slash resulting from logging pine, Douglas-fir, and spruce have yielded
69 measurements sometimes over 100 tonnes per hectare; in the case of lodgepole pine, over
70 50 tonnes per hectare just for the portion of the trees above the non-merchantable top. As
71 collateral damage, slash burning also results in oxidation of the carbon in cutblock
72 deadwood, soils, bushes, and so on, much of which is anything but dry and which

73 therefore produces all kinds of pollutants other than the greenhouse gases. So the true
74 total for B.C. carbon dioxide-equivalent emissions from slash burning could amount to
75 something like 40 megatonnes a year. For comparison, the Government of British
76 Columbia asserts that in 2014 total greenhouse gas emissions in B.C. aside from forestry
77 and agriculture were 64.5 megatonnes of carbon dioxide equivalent. In the same year,
78 carbon dioxide equivalent totals for each of Finland, Norway, and Sweden were about 54
79 megatonnes, aside from forestry and agriculture.

80
81 Why is there so little public consciousness of such atrocious greenhouse gas emissions
82 into the atmosphere? Until about twenty years ago, climate-change deniers and timorous
83 governments could pretend that greenhouse gas emissions from forestry were not a
84 problem, because whatever greenhouse gases were emitted were being recaptured by
85 regrowth of plantations. Over an eighty-year period, the story went (and still goes), all
86 the carbon dioxide liberated from the burning of slash would be taken up as new wood.
87 In fact, because so much of the Canadian and British Columbian landscape had already
88 been logged and was coming up in new trees, Canadian forestry was withdrawing more
89 carbon dioxide than it was releasing. Therefore what provincial and federal policy should
90 do, the reasoning has been, is encourage even higher rates of logging old growth,
91 replacing natural forests of slow-growing trees with plantations of fast-growing selection
92 trees.

93
94 Burning forestry slash is irrational

95

96 From several perspectives, a policy of burning forestry slash is irrational. *First, the harms*
97 *from burning forestry slash greatly outweigh even the alleged benefits, much less the*
98 *proven benefits.* The overwhelming consensus of the finest climate scientists in the world
99 is that humanity has already launched planet Earth towards global catastrophe. What
100 benefits to B.C. forestry could equal or exceed the roasting, drying, and flooding of
101 landscapes that are home to hundreds of millions of people and most of the ecosystems of
102 the world? What benefits to the B.C. economy could justify shortening the lives of
103 hundreds of thousands of people obliged to breathe smoke from slash burning?
104
105 *Second, there is almost no scientific basis for slash burning.* The reasons commonly
106 given for burning slash are (i) Reduction of Wildfire; (ii) Minimization of Unproductive
107 Land Base; (iii) Low Cost (vs. some alternatives); and (iv) Aesthetics and Tree Planter
108 Safety. All of them seem to derive from commonsense lay thinking rather than research.
109 Concerning (i), Reduction of Wildfire, almost no research beyond modelling studies
110 supports the idea that burning slash reduces wildfire for more than a very few years. See
111 the highly rigorous, peer-reviewed 2016 research article “Greenhouse gas emission effect
112 of suspending slash pile burning in Ontario’s managed forests” (*The Forestry Chronicle*
113 92(3): 345-356) by Michael T. Ter-Mikaelian, Stephen J. Colombo, and Jiaxin Chen, p.
114 354: “...Ascertaining the increased fire risk posed by unburned slash piles would require
115 a detection of statistically significant difference in the long-term average characteristics
116 of fire regimes between similar forest landscapes with contrasting treatment of slash piles
117 (burn vs. no burn). In the absence of such tests, attributing a fraction of GHG emissions
118 from wildfires to unburned slash piles would be impossible....” When this explanation is

119 offered verbally by forestry professionals, it is rarely if ever accompanied by recognition
120 that burning slash accelerates global climate change, one consequence of which is more
121 frequent forest fires.

122
123 Concerning (ii), Minimization of Unproductive Land Base, it is likewise very poorly
124 supported by research. Again, see Ter-Mikaelian et al. (2016), as above. The notion that
125 small percentages of the productive landscape will be missed in the future relies very
126 heavily on the mistaken or deliberately misleading assumption that future climates will be
127 the same as historic ones – a state of affairs which slash burning helps ensure will never
128 eventuate.

129
130 Concerning (iii) Low Cost as compared with other methods of ridding slash from the
131 productive land base, presumably it is the true reason why the B.C. government condones
132 and encourages burning of forestry slash as opposed to burial or chipping. But it too is
133 less a reason than an irrational preference. Not burning slash at all would be much
134 cheaper. Serious alternatives such as in situ reduction of slash to biochar have never been
135 examined by Canadian governments. Two or three research articles on burial of slash
136 suggest burial costs roughly the same as for burning (while pre-empting hundreds of
137 millions, or billions, of dollars in health costs which slash smoke imposes).

138
139 Concerning (iv), Aesthetics and Tree Planter Safety, there is really no scientific literature
140 on these subjects at all. So far as can be determined through Web searches, the Province

141 of British Columbia does not even keep separate statistics on tree planter accidents in the
142 field.

143
144 *Third* in this quick flyover of the irrationality of B.C. forestry slash burning, *we do not*
145 *have 80 years, or even 40 years, to grow wood replacing the wood harvested from*
146 *natural forests today. We have no time at all.* According to the latest determinations of
147 the International Panel on Climate Change, by 2030 the world will be committed to one
148 or another of several trajectories making catastrophic climate change all but certain.
149 During the next *12* years humankind must halt the growth in atmospheric carbon dioxide
150 levels and set them to declining. Planting fast-growing trees in new clearcuts in British
151 Columbia will do nothing to help bring about that short-term change. Ceasing to burn
152 forestry slash, however, could, and immediately.

153
154 *Fourth, either deliberately or through institutionalized ignorance, the Government of*
155 *British Columbia has minimized the environmental significance of slash burning.* It has
156 done so by failing to measure the slash resulting from actual clearcuts; failing to quantify
157 slash production from the logging of different kinds of forest growing on sites of different
158 kinds; failing to age the trees subject to clearcutting; utilizing garbage-in, garbage-out
159 models in reporting carbon dioxide emissions from logging; failing to include greenhouse
160 gas production as an element in Forest Stewardship Plans; distracting public attention
161 from greenhouse gas emissions from slash burning by acknowledging only that slash
162 smoke is a public health problem; and generally having nothing to say about greenhouse

163 gas emissions from forestry slash burning. As a result, forestry slash burning has been
164 subject to almost no serious public scrutiny.

165
166 *Fifth, there are at least five alternatives to burning forestry slash:* Conversion to biochar;
167 Burial; Piling but not burning, and In situ scattering; Manufacturing into pellets,
168 panelboard, and so on; and Combinations of methods. All of these alternative methods
169 are scientifically defensible.

170
171 Formal requirements of framing B.C. forestry slash burning as a crime against humanity

172
173 In Canadian and international law, a charge of “crime against humanity” would need to
174 fit into a narrow institutional context and meet several well-defined requirements. Until
175 recently, there was no international institution mandated to try crimes against humanity
176 outside wartime. There is now: the International Criminal Court. What is more, until
177 2017 the ICC would not hear cases of alleged environmental atrocities, but as of 2017 it
178 has agreed to do so.

179
180 Unfortunately, as the International Criminal Court is set up, alleged crimes against
181 humanity must first be tried in the legal system of the country where the alleged crime
182 was committed. It is doubtful that will happen in Canada any time soon. Canadians and
183 the provincial and national governments they elect have consistently tolerated the
184 commission of extremely serious harms to human health and welfare so long as jobs
185 appear to be at stake and so long as the actors are corporate persons or Ministers. In fact,

186 in Canada, if an individual deliberately or knowingly poisons another human being for
187 some personal benefit or advantage, it is a very serious crime; but if a corporate person
188 deliberately or knowingly poisons hundreds or thousands of people as a business or
189 political decision to contaminate the environment, the penalties may be light or non-
190 existent. A paradigm example is the dumping of 20,000 pounds of mercury into the
191 Wabigoon River, contaminating the staple food of the Grassy Narrows and
192 Wabaseemoong First Nations of northern Ontario and severely damaging the health of
193 more than 1,000 people from about 1962 to the present day. Apparently neither the pulp
194 and paper companies which carried out the dumping nor the political and bureaucratic
195 decision-makers who countenanced it ever faced criminal charges. Fear of job loss
196 excused irresponsible pollution and willful blindness to an environmental atrocity.

197
198 On the face of it, the B.C. policy condoning and encouraging forestry slash burning really
199 does give the appearance of being a crime against humanity. The policy contributes
200 mightily to the catastrophic degradation of climate around the world, degradation which
201 according to hundreds of peer-reviewed scientific studies is already harming the welfare
202 of millions of human beings, all over the planet. There is evidence of a guilty mind
203 (*mens rea* – “the intention or knowledge of wrongdoing that constitutes part of a crime”
204 according to the *Concise Oxford English Dictionary*). There are “persons” responsible
205 for the alleged crime, either the corporate person (currently the B.C. Ministry of Forests,
206 Lands and Natural Resource Operations & Rural Development) or the Ministers who
207 have perpetuated the policy of condoning or encouraging slash burning. There is an
208 international body which tries cases of crimes against humanity, namely the International

209 Criminal Court. Finally, in just the past two or three years the International Criminal
210 Court has indicated it will hear cases of crimes against humanity in which the alleged
211 harms are environmental in nature. None of this matters, however, if Canadian
212 governments refuse to bring political decision-makers to trial by the ICC.

213

214 Another problem is that the concept of “crimes against humanity” has evolved in close
215 association with atrocities committed in wartime. Although the International Criminal
216 Court now includes environmental atrocities within the scope of its trials, what it seems
217 to be concerned with currently is environmental atrocities carried out in the course of
218 warfare. In British Columbia, slash burning is unrelated to war.

219

220 Ecocide

221 Less well known than “crimes against humanity” is the concept of *ecocide* – defined by
222 the United Nations International Law Commission as an environmental harm which is
223 widespread (encompassing an area on the scale of several hundred square kilometres),
224 long lasting (lasting for a period of months, or approximately a season), or severe
225 (involving serious or significant disruption or harm to human life, natural and economic
226 resources or other assets). (See the Wikipedia article on Ecocide.) Hossay (2006)
227 includes a short but convincing outline of global ecocide and the dominant role
228 deforestation plays in it.

229

230 As far back as 1985, the draft United Nations document *Code of Crimes against the*
231 *Peace and Security of Mankind* included Ecocide as a crime against peace. For reasons

232 sufficiently obscure to have become the focus of a study by the Human Rights
233 Consortium at the School of Advanced Studies, University of London, ecocide was
234 gradually sidelined as the “fifth international Crime against Peace.” However, British
235 lawyer and author Polly Higgins, principally through her 2010 book *Eradicating*
236 *Ecocide: Laws and Governance to Prevent the Destruction of our Planet*, has laid out a
237 fairly simple and straightforward path to establishing Ecocide as an International Crime
238 against Peace to impose a legal duty of care “to prevent, prohibit and pre-empt both
239 ecological and climate ecocide.”
240
241 On 2011 January 11, Andrew Gage, Staff Counsel for West Coast Environmental Law,
242 Web-published the item *Ecocide in Canada* “to make some observations on the legal
243 issues around recognizing ecocide in Canadian criminal law.” In this article, Gage
244 considers that according to an opinion the Supreme Court of Canada has expressed,
245 “there would be nothing preventing Canada’s Parliament from enacting a criminal law
246 against ecocide.” Gage says there might nevertheless be a problem with importing Polly
247 Higgins’ particular conception of ecocide into Canadian law because Higgins proposes
248 that ecocide should be a crime of strict liability -- crimes of strict liability do not have a
249 requirement of mens rea, a guilty mind -- and the Canadian Supreme Court has held that
250 “the accused who committed the prohibited act did so intentionally or recklessly, with
251 knowledge of the facts constituting the offence, or with wilful blindness toward them.”
252 However, Gage himself offers three reasons why it might not be necessary to characterize
253 ecocide as a strict liability offence in Canadian criminal law. And beyond the reasons
254 Gage itemizes, in at least some cases it might be quite feasible to prove that an act of

255 ecocide was performed with a guilty mind, or at least “recklessly,” or “with knowledge of
256 the facts constituting the offence, or with wilful blindness toward them,” in the words of
257 the Supreme Court quoted by Gage. The Law Reform Commission of Canada, in its
258 Working Paper 44, *Crimes against the Environment*, 1985, in the section “Intent,
259 Recklessness, Negligence,” seems to support this line of thinking.

260

261 How close is Ecocide to becoming an international Crime against Peace? Perhaps closer
262 than one would think. The European Parliament has discussed a European Citizens
263 Initiative with the title “End Ecocide in Europe.” According to Wikipedia, “Ten
264 countries have codified ecocide as a crime during peacetime.” There seems to be
265 growing public awareness of the concept of ecocide among European publics.

266

267 How close is ecocide finding its way into Canadian criminal law? It is true that more and
268 more members of the Canadian public regard climate change as an environmental
269 problem of unsurpassed seriousness. It is also encouraging that the Law Reform
270 Commission (1985) addressed the possibility that certain kinds of environmental harms
271 might be recognized as so abhorrent that they would be codified as “crimes.”

272 Unfortunately, the same Working Paper 44 of the Commission notes that “It is generally
273 acknowledged in our [Canadian] political and economic system, and in our
274 environmental policies and laws, that there are a number of legitimate social purposes
275 which can justify, at least for a period of time, varying degrees of pollution, deterioration
276 and risk – which permit downgrading the pollution harm and risk from serious and
277 intolerable to less-than-serious and tolerable. ... Primary among the goals and purposes

278 implicitly or explicitly underlying environmental policies, regulations and statutes are
279 economic ones.”

280
281 Of course that is the nub of it – that British Columbian politicians, following public
282 opinion rather than leading it, and typically neither well educated nor well read in
283 environmental science, will continue to acknowledge climate change as serious but
284 behave as if it is not so serious as job creation and incomes. To which, the authors of
285 Working Paper 44 made the following suggestion:

286
287 In any event, the life and health of others cannot be traded off for other apparent
288 benefits, whether economic or other. We do not permit such a trade-off for other
289 criminal offences involving serious harms or dangers to human life and bodily
290 integrity. That being so, we may formulate the following by way of a general
291 criterion: ...The more certain is the evidence or likelihood of present or future
292 harm and danger to human life and health, and the more serious the nature of that
293 harm and danger, the less legitimate and persuasive should be other socially
294 useful goals as justifications for the pollution or for reducing its classification
295 from serious to minor, and the more compelling would be arguments for the
296 criminal nature of that activity.

297
298 More specifically, Working Paper 44 states that for the Law Reform Commission
299 of Canada, “The preferred approach is that of formulating a new and special
300 offence of a ‘crime against the environment.’ In explanation, “The present

301 *Criminal Code* in effect prohibits offences against persons and property. It does
302 not, in any explicit or direct manner, prohibit offences against the natural
303 environment itself. In this Working paper, the Commission makes and supports
304 the proposition that the natural environment should now become an interest
305 explicitly protectable in some cases in the Criminal Code. Some acts or
306 omissions seriously harmful or endangering to the environment should, if they
307 meet the various tests of a real crime, be characterized and prohibited for what
308 they are in the first instance, crimes against the environment.”

309
310 Continuing, the Law Reform Commission further explains that “Five tests or at
311 least signposts were proposed... [in the Ouimet Report of 1969] by which to
312 determine whether or not a particular offence should continue to be classified and
313 prohibited as a real crime or reduced to the status of a regulatory offence.

314 Offences should be considered real crimes only if: they contravene a fundamental
315 value; they are seriously harmful; they are committed with the required mental
316 element; the needed enforcement measures would not themselves contravene
317 fundamental values; and treating them as crimes would make a significant
318 contribution to dealing with the harms and risks they create.”

319
320 Despite the difficulties entailed by the possible requirement of mens rea (“they are
321 committed with the required mental element”), the Law Reform Commission
322 concluded that “Environmental pollution might be a crime if it were grossly
323 negligent, reckless or intentional” – and it seems likely that any impartial person

324 would regard the B.C. policy of “polluting” the global atmosphere with gigantic
325 quantities of greenhouse gases through mandating forestry slash burning as
326 clearly reckless, but also grossly negligent, in view of the failure of Ministers and
327 upper-echelon ministry officials to treat forestry slash burning as a crisis, and
328 arguably intentional or at least the product of wilful blindness, self-deception, and
329 deliberate deception of the British Columbian public.

330

331 The highly considered legal opinions of the Law Reform Commission cited above
332 strongly support the view that if no other class of environmental harms deserves to be
333 categorized as crimes, serious harms to the sustainability of the global climate are such a
334 class. We recollect that the World Health Organization and the International Panel on
335 Climate Change have both meticulously itemized how human-driven climate change has
336 already harmed the health and welfare of hundreds of thousands of human beings and is
337 almost certain to harm the health and welfare of tens or hundreds of millions more in
338 future.

339

340 So does it make practical legal sense to frame the British Columbia policy of burning
341 forestry slash as a crime against humanity? Evidently it does not, because the
342 International Criminal Court would probably refuse to try a case of serious environmental
343 crime not committed in wartime, and the case would first have to be tried in a Canadian
344 court before the ICC would even consider it. Could the B.C. slash burning policy
345 reasonably be characterized as ecocide, a class of serious environmental crimes
346 committed during peacetime, with the prospect of imminent changes in international law?

347 Recognition of ecocide as the “Fifth Crime against Peace” might fit the bill, provided the
348 International Criminal Court began to prosecute ecocide and Canada became one of the
349 countries with ecocide in their criminal codes. Mobilization of public opinion in favour
350 of changes of this kind, however, may be difficult to bring about, and the changes
351 themselves would be slow to bring about real results. Could the political and
352 bureaucratic decision-makers who oversee slash-burning policy in British Columbia at
353 least be pursued under some existing provision of the Criminal Code of Canada for the
354 harms they are imposing on human beings? They might, but not as things stand, in view
355 of the Canadian tradition of “tolerating pollution for legitimate social purposes,” as
356 identified by the Law Reform Commission.

357
358 This somewhat discouraging assessment of the current state of legal affairs in Canada
359 does point to a direction more and more Canadians might support in the short term if it
360 were convincingly advocated. That is for *the inclusion of at least one sort of*
361 *environmental harm in the Criminal Code as having no escape clauses for alleged*
362 *political or bureaucratic perpetrators*, namely something like “Mandating serious harm
363 to the integrity of the global climate,” or, for short and for emphasis, Crimes against the
364 Global Climate; and, following on a suggestion in the Law Reform Commission’s Paper
365 44, a stipulation that Crimes against the Global Climate be decided by jury, since “the
366 jury may have a unique and important role to play in the balancing of harm and social
367 utility.” The Law Reform Commission Paper does not say so, and its authors would
368 likely not have known, but researchers in historical environmental degradation have
369 documented many cases of societies led to catastrophe by leaders acting in their own

370 interests and in defiance of enlightened resistance by the general population. The
371 Common Law jury institution is meant to ensure the views of ordinary people are
372 represented in legal decisions.

373
374 To sum up: If any government-mandated activity produces harm to the global climate out
375 of all proportion to its claimed utility, it surely has to be the burning of logging slash in
376 British Columbia. So this essay concludes with a strong recommendation that
377 environmentally concerned citizens should press for (1) inclusion of any policy massively
378 contributing to global climate change as a crime under the Criminal Code of Canada, (2)
379 framing that crime as one committed by government and industrial decision-makers, with
380 no opportunity for pleading that the policy is excusable as pursuing “legitimate social
381 purposes;” and (3) requiring the use of the Common Law jury in deciding such cases.

382
383 Finally, here is a nomination for the first case to be tried under a prosecution for a crime
384 against global climate: The still active policy of the British Columbia government
385 mandating the burning of logging slash.

386

387

388 Postscript – New research on the genetic effects of air pollution

389

390 An extremely well-designed study reported in the peer-reviewed journal *Nature*
391 *Communications* (Fave et al., 2018) demonstrates that atmospheric pollution actually
392 modifies gene expression to such an extent that it overpowers the normal differences

393 between individuals attributable to genetic ancestry. "...Our findings demonstrate how
394 the local environment directly affects disease risk phenotypes and that genetic
395 variation...can modulate individuals' response to environmental challenges." And: "We
396 find that the expression profiles of differentially expressed genes between regions are
397 largely associate with gradients of annual ambient air composition across Quebec...."
398 The four main pollutants identified in the study were PM2.5, NO₂, SO₂, and O₃ – all of
399 which, but especially the first three, are emitted in huge quantities by the burning of
400 forestry slash.

401
402 Fave et al. (2018) state that "The four clinical traits that were found to bbe associated
403 with differential gene expression (FEVI, lung disease, live enzymes, and arterial
404 stiffness) are consistently reported as influenced by air pollution by other studies.
405 Chronic diseases developing from these detrimental endophenotypes (asthma and
406 cardiovascular diseases) are well documented to be associated with air pollution levels."
407 And: "This suggests that environmental differences in air quality may act on the
408 regulation of several genes and pathways and promote pro-inflammatory states which can
409 lead to cardiorespiratory dysfunction."

410
411 The Fave et al. study therefore raises the possibility that a policy mandating the burning
412 of forestry slash could be regarded as a roundabout form of genocide – the subjecting of
413 large populations to modifications in genetic makeup which render individuals, no matter
414 what their ancestry, susceptible to serious and even fatal diseases simply because of

415 where they reside. It remains to be seen how this kind of environmental atrocity, if
416 supported by further research, could be handled under international and Canadian law.

417

418

419

420 **References and notes**

421

422 Lines 9-17

423 During September and October of 2015, massive and unusual volumes of smoke drifted
424 from certain parts of Indonesia across the Malay Peninsula, including Singapore and
425 Kuala Lumpur, as well as densely populated regions of Indonesia itself. The smoke
426 originated in extensive fires set to burn agricultural residue and slash from forest
427 clearance, but also from accidentally ignited peat fires. Subsequent research estimated
428 that the smoke resulted in 100,000 excess deaths across Indonesia, Malaysia, and
429 Singapore. See Shannon N. Koplitz, Loretta J. Mickley, Miriam E. Marlier, Jonathan J.
430 Buonocore, Patrick S. Kim, Tianjia Liu, Melissa P. Sulprizio, Ruth S. DeFries, Daniel J.
431 Jacob, and Joel Schwartz (2016), “Public health impacts of the severe haze in Equatorial
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433 management strategies to reduce downwind smoke exposure”, *Environmental Research*
434 *Letters 11(9)*, accessed online on 2017-12-02 at
435 <http://iopscience.iop.org/article/10.1088/1748-9326/11/9/094023>. At the time, “Sutopo
436 Puro Nugroho, the spokesperson for the [Indonesian] Meteorology, Climatology and
437 Geophysics Agency (BMKG),” was quoted as saying, “This is a crime against humanity
438 of extraordinary proportions” Kate Lamb, “Indonesia’s fires labelled a ‘crime against
439 humanity’ as 500,000 suffer,” *The Guardian*, 2015 October 26, accessed online on 2017
440 December 13 at: [https://www.theguardian.com/world/2015/oct/26/indonesias-fires-](https://www.theguardian.com/world/2015/oct/26/indonesias-fires-crime-against-humanity-hundreds-of-thousands-suffer)
441 [crime-against-humanity-hundreds-of-thousands-suffer](https://www.theguardian.com/world/2015/oct/26/indonesias-fires-crime-against-humanity-hundreds-of-thousands-suffer)).

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443

444 Lines 38-40

445

446 Data are from a PDF attached to an email message from Dave Stevens, “Burn Piles by
447 Week, Fall 2017,” 2017-11-30. Mr. Stevens is the public representative on the Bulkley
448 TSA Smoke Management Committee.

449

450 Lines 47-79

451

452 Logging operations in British Columbia produce staggering quantities of “slash”
453 incidental to the commercial timber actually removed from the cutblocks. Most of this
454 waste material – treetops, branches, stumps, leaves, deadwood, and so on – is burned. In
455 2017, for example, timber operators in the Bulkley and Lakes District Timber Supply
456 Areas (TSAs) issued notices for the burning of 27,332 nominal slash “piles.” On
457 average, by the most conservative estimates, a slash “pile” has a mass of 25 tonnes.
458 (Government and industry documents state that the slash from one hectare of clearcut is
459 considered to be equivalent to two slash “piles,” no matter what the actual size or number
460 of slash piles.) Therefore in 2017 the Bulkley and Lakes District TSAs burnt something
461 like $27,332 \times 25 = 683,300$ tonnes of slash. Because the burning of 1 tonne of wood
462 emits roughly 1.9 tonnes of carbon dioxide, to say nothing of several more potent GHGs,
463 the burning of slash in these two TSAs released $683,300 \times 1.9 = 1,298,270$ or almost
464 1,300,000 tonnes of carbon dioxide. In greenhouse science parlance, 1,300,000 tonnes is
465 1.3 megatonnes. British Columbia as a whole is divided into 37 TSAs, and each year
466 about 200,000 ha of B.C. forest lands, according to government literature, is harvested.
467 At a rough estimate, then, the province as a whole might be burning $200,000 \times 2 \times 25 =$
468 $10,000,000$ tonnes of slash and in doing so it would be liberating close to 20 megatonnes
469 of carbon dioxide into the atmosphere. Since the nominal figure of 50 tonnes of slash per
470 hectare may understate the actual amount of slash by as much as 100%, the true total for
471 B.C. carbon dioxide emissions from slash burning could approach 40 megatonnes a year.
472 (Although some of the 37 Timber Supply Areas in the province use more of their slash as
473 feedstock for manufacturing, others harvest kinds of forest which produce more slash
474 than the lodgepole pine-spruce forests of the Bulkley-Lakes TSA. As collateral damage,
475 slash burning also results in oxidation of the carbon in cutblock deadwood, soils, bushes,
476 and so on.) For comparison, the Government of British Columbia document *Trends in*
477 *Greenhouse Gas Emissions in B.C. (1990-2014)* asserts that “Total greenhouse gas
478 emissions in 2014 in B.C. were 64,500 kilotonnes [= 64.5 megatonnes) of carbon dioxide
479 equivalent:” <http://www.env.gov.bc.ca/soe/indicators/sustainability/ghg-emissions.html>.

480
481 See also (1) *British Columbia’s Forests: A Geographical Snapshot*, available online at
482 <https://www.for.gov.bc.ca/hfd/pubs/docs/mr/mr112/contents.htm>

483 ...
484 (2) *Voices for Good Air, Scientific Methods of Measuring Slash Volume and Weight*,
485 available online at
486 [https://can-bv.ca/wp-content/uploads/2017/11/Voices-Bulletin-Scientific-Methods-of-](https://can-bv.ca/wp-content/uploads/2017/11/Voices-Bulletin-Scientific-Methods-of-Measuring-Slash-Volume-and-Weight.pdf)
487 [Measuring-Slash-Volume-and-Weight.pdf](https://can-bv.ca/wp-content/uploads/2017/11/Voices-Bulletin-Scientific-Methods-of-Measuring-Slash-Volume-and-Weight.pdf)

488 ...

489 Lines 81-92

491
492 (1) Government of Canada, *Pan-Canadian Framework on Clean Growth and Climate*
493 *Change*, section on Forestry, Agriculture, and Waste, at

494
495 [https://www.canada.ca/en/services/environment/weather/climatechange/pan-canadian-](https://www.canada.ca/en/services/environment/weather/climatechange/pan-canadian-framework/complementary-actions-reduce-emissions.html#3_5)
496 [framework/complementary-actions-reduce-emissions.html#3_5](https://www.canada.ca/en/services/environment/weather/climatechange/pan-canadian-framework/complementary-actions-reduce-emissions.html#3_5)

497

498 (2) See the B.C. *Climate Leadership Plan*, August 2016 (policy under the Liberal
499 government in B.C. but apparently not superseded by any new policy under the B.C.
500 NDP and Green Party government arrangement:
501

502 https://climate.gov.bc.ca/app/uploads/sites/13/2016/10/4030_CLP_Booklet_web.pdf
503

504
505 Lines 98-99
506

507 See the reports of the Intergovernmental Panel on Climate Change, especially *Highlights*
508 *of the IPCC Fifth Assessment Report*:
509

510 https://www.google.ca/imgres?imgurl=https://image.slidesharecdn.com/01syntreportar5y-sokona-151207120217-1va1-app6892/95/highlights-of-the-ipcc-fifth-assessment-report-1-638.jpg?cb%3D1449489762&imgrefurl=https://www.slideshare.net/ipcc-media/highlights-of-the-ipcc-fifth-assessment-report-55890466&h=479&w=638&tbnid=aE5zX9o9-JQ4uM:&tbnh=160&tbnw=213&usq=__DyEOtvKfyxf2CPBhq3WLbJ1UGyA%3D&vet=10ahUKEwjPtt-gq4PaAhUE-lQKHd-UD9AQ_B0IkwEwDQ..i&docid=Yut8S6OQ3uRi1M&itg=1&sa=X&ved=0ahUKEwjPtt-gq4PaAhUE-lQKHd-UD9AQ_B0IkwEwDQ
511
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520 ...and the *IPCC Fifth Assessment Report – Synthesis Report*:
521

522 <https://www.slideshare.net/IPCCGeneva/fifth-assessment-report-synthesis-report>
523
524

525 Lines 135-137
526

527 See, for example, Ning Zeng, 2008, “Carbon sequestration via wood burial,” *Carbon*
528 *Balance and Management* 3:1 (not paginated as in the paper version because online):
529 https://www.researchgate.net/publication/5675870_Carbon_sequestration_via_wood_burial.
530
531

532
533 Lines 144-150
534

535 See the *IPCC Fifth Assessment Report*, cited under the second note preceding.
536
537

538 Lines 166-169
539

540 See Voices for Good Air, *Position Paper on Smoke and Carbon Emissions from Forestry*
541 *Slash Burning* (2017 April 20), available over the Web at [https://can-bv.ca/wp-](https://can-bv.ca/wp-content/uploads/2017/04/Voices-CAN-Position-Paper-April-20.pdf)
542 [content/uploads/2017/04/Voices-CAN-Position-Paper-April-20.pdf](https://can-bv.ca/wp-content/uploads/2017/04/Voices-CAN-Position-Paper-April-20.pdf).
543

544 One reviewer commented that some critics of this paper might argue that if the interior
545 B.C. forests aren't logged first, wildfires will reduce them to greenhouse gases and
546 smoke. The shortcomings of this line of argument are that:

547
548 (1) Logging can continue in the absence of slash burning so long as the carbon in
549 the slash is sequestered in some fashion such as through burial or conversion to
550 biochar which is incorporated into the soil;

551
552 (2) At current levels of the burning of B.C. forests in wildfires, even if the level
553 of 2017 became the new normal, it would be at least forty or fifty years before all
554 the B.C. interior forest was reduced to ash and carbon dioxide, and long before
555 then either humanity will have brought in a broad suite of measures to stabilize
556 and ultimately reverse climate change or the world will be almost uninhabitable
557 anyway;

558
559 (3) All forest fires are additional to forestry slash burned, or at least there is
560 essentially no scientific quantification of how much wildfire is pre-empted by
561 burning slash – after a few years, in the opinion of Ter-Mikaelian et al. (2016),
562 next to none -- but there is no question that ceasing to permit the burning of
563 forestry slash would immediately reduce the amount of smoke people breathe in
564 B.C. since the smoke and associated gases are up and beyond whatever results
565 from forest fires; and

566
567 (4) The scientific evidence is that forest fires consume only a fraction of the
568 wood, hence carbon, in any area that gets burned over, and whatever wood is
569 reduced to charcoal rather than to CO₂ becomes almost indefinitely inert; a book
570 review by Chad Hanson (2018) in *Bioscience* 68(2), p. 146, refers to “scientific
571 research indicating that surprisingly little forest carbon is actually consumed in
572 wildland fires and that forests go from carbon source to carbon sink in a relatively
573 short period of time following fire because of postfire growth spurred by fire-
574 mediated nutrient cycling;” Hanson cites a recent peer-reviewed journal article.

575
576 (5) Hanson (2018), mentioned in item (4) immediately above, also refers to
577 “important scientific evidence...including studies concluding that old, long-
578 unburned forests do not tend to burn more severely than other forests...and
579 landscape-level research finding that increased logging does not tend to reduce
580 fire severity – and generally has the opposite effect.... Ironically, if increased
581 logging is intended as a measure to curb wildland fire in a changing climate,
582 current evidence indicates that such an approach would have the net effect of
583 substantially reducing forest carbon storage and increasing carbon emissions....”

584
585
586 Lines 173-178

587

588 On 2016 September 16, the International Criminal Court announced it is prepared to
589 prosecute individuals who have committed atrocities by causing environmental
590 destruction, which are a class of crimes against humanity.

591
592 See: International Criminal Court, Office of the Prosecutor, *Policy Paper on Case*
593 *Selection and Prioritisation*, [https://www.icc-cpi.int/itemsDocuments/20160915_OTP-](https://www.icc-cpi.int/itemsDocuments/20160915_OTP-Policy_Case-Selection_Eng.pdf)
594 [Policy_Case-Selection_Eng.pdf](https://www.icc-cpi.int/itemsDocuments/20160915_OTP-Policy_Case-Selection_Eng.pdf).

595
596 Currently, the International Criminal Court is considering at least one complaint of
597 environmental abuse. See Charlotte Smith 2017-12-13, “Report: Will the ICC’s Shift in
598 Focus to Environmental Atrocities be Effective?” *North Carolina Journal of*
599 *International Law*, as accessed at [http://ncilj.org/report-will-the-iccs-shift-in-focus-to-](http://ncilj.org/report-will-the-iccs-shift-in-focus-to-environmental-atrocities-be-effective/)
600 [environmental-atrocities-be-effective/](http://ncilj.org/report-will-the-iccs-shift-in-focus-to-environmental-atrocities-be-effective/) on 2017 December 13. According to Smith
601 (2017), “As a result of the ICC transitioning its priorities towards environmental
602 destruction, corporate persons may now be susceptible to prosecution by the ICC for
603 international crimes. ... By investigating and adjudicating complaints formally filed,
604 and addressing environmentally destructive activities, the ICC could fill the impunity gap
605 that exists between individuals committing egregious human rights violations and CEOs
606 acting on behalf of businesses committing environmental destruction that tends to lead to
607 human rights abuses.”

608
609
610 Lines 190-196

611
612 See John Michael McGrath, “How the Waters of Grassy Narrows were Poisoned,” *TVO*
613 *Current Affairs* 2016 September 23: [https://tvo.org/article/current-affairs/shared-](https://tvo.org/article/current-affairs/shared-values/how-the-waters-of-grassy-narrows-were-poisoned)
614 [values/how-the-waters-of-grassy-narrows-were-poisoned](https://tvo.org/article/current-affairs/shared-values/how-the-waters-of-grassy-narrows-were-poisoned)

615
616
617 Lines 209-212

618
619 See Charlotte Smith, “Report: Will the ICC’s Shift in Focus to Environmental Atrocities
620 be Effective?” in *North Carolina Journal of International Law* 43, 2016 November 17:
621 [http://ncilj.org/report-will-the-iccs-shift-in-focus-to-environmental-atrocities-be-](http://ncilj.org/report-will-the-iccs-shift-in-focus-to-environmental-atrocities-be-effective/)
622 [effective/](http://ncilj.org/report-will-the-iccs-shift-in-focus-to-environmental-atrocities-be-effective/). According to Smith, “The systematic crimes committed under the guise of
623 ‘development’ are no less damaging to victims than many wartime atrocities. ... The
624 ICC Prosecutor has sent a clear message that such offences may amount to crimes against
625 humanity and can no longer be tolerated.” However, the problem with prosecuting
626 environmental atrocities committed in Canada is that, as Smith states, “The ICC
627 necessarily relies on the cooperation of states expressly party to the Rome Statute to
628 actually bring any of the suspects to trial.”

629
630 For more on the shift in ICC prosecution policy, see Harsh Mahaseth, 2016 October 3,
631 “Environmental Destruction: A Shift in the International Criminal Court’s Priorities,”
632 *Business & Resources & Environment & Development*,” Oxford Human Rights Hub,

633 2016 October 3: [http://ohrh.law.ox.ac.uk/environmental-destruction-a-shift-in-the-](http://ohrh.law.ox.ac.uk/environmental-destruction-a-shift-in-the-international-criminal-courts-priorities/)
634 [international-criminal-courts-priorities/](http://ohrh.law.ox.ac.uk/environmental-destruction-a-shift-in-the-international-criminal-courts-priorities/).

635
636
637 Lines 220-227

638
639 See the quite good Wikipedia entry on Ecocide: <https://en.wikipedia.org/wiki/Ecocide>.

640
641 Hossay, Patrick. 2006. *Unsustainable: A Primer for Global Environmental and Social*
642 *Justice*. Zed Books: London.

643 .
644
645 Lines 230-239.

646
647 Polly Higgins (2010 and 2015), *Eradicating Ecocide: Laws and Governance to Prevent*
648 *the Destruction of Our Planet*. London: Shephard-Walwyn, 2010 (1st ed.) and 2015 (2nd
649 ed.).

650
651
652 Lines 241ff.

653
654 Online at <https://www.wcel.org/blog/ecocide-canada>.

655
656
657 Lines 261-265

658
659 See Wikipedia entry cited above under Lines 220-227.

660
661 Lines 269ff.

662
663 Law Reform Commission of Canada. 1985. *Crimes against the Environment*. Working
664 Paper 44. Department of Justice Canada. <http://www.lareau-law.ca/LRCWP44.pdf>.

665
666
667 Lines 284ff.

668
669 Law Reform Commission of Canada (1985), Working Paper 44, as cited immediately
670 above.

671
672
673 Lines 313ff.

674
675 On the concept of ecocide being the fifth crime against peace, see Polly Higgins,
676 “Ecocide was to be the 5th Crime against Peace,” *Common Ground*, 01/08/2012.

677
678

679 Lines 328ff.

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681 See citation under Lines 269ff. above.

682

683

684 Lines 390ff.

685

686 A free-access version of the article is available over the Internet:

687

688 Fave, Marie-Julie; Fabien C. Lamaze; David Soave; Alan Hodgkinson; Heloise Gauvin;

689 Vanessa Bruat; Jean-Christophe Grenier; Elias Gbeha; Kimerly Skead; Audrey

690 Smargiassi; Markey Johnson; Youssef Idaghdour; and Philip Awadalla. 2018. Gene-by-

691 environment interactions in urban populations modulate risk phenotypes. *Nature*

692 *Communications* 9, Article number 827: [https://www.nature.com/articles/s41467-018-](https://www.nature.com/articles/s41467-018-03202-2)

693 [03202-2](https://www.nature.com/articles/s41467-018-03202-2).

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