Foreword

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‘Men argue. Nature acts.’ These profound words were spoken more than 250 years ago by the famous French philosopher and writer Voltaire. In the spirit of cumulative impact assessment (CIA), this phrase is proving to be prescient, and well illustrates the dilemma between what scientists are discovering about global ecosystems deterioration, and the opposing forces that wish to keep profit maximized and the current carbon-based industrial machine functioning at all costs.

Data concerning climate change, biodiversity loss, potable water availability, ocean acidification and soil degradation, among many others, are showing that our civilization is altering the planet in myriad disturbing ways. Although the International Commission on Stratigraphy (ICS) has not yet made a formal decision, many scientists, regulators, and civil society organizations believe we have entered a new epoch called the Anthropocene. Should this designation happen, such a naming of a new epoch will conclude without any doubt that the cumulative actions of humans are irrevocably and negatively affecting the life support systems of Earth.

Regardless of the ICS’s future decision on the Anthropocene, two-thirds of all the land and oceans have been in some way altered by human actions (Morris et al., 2020), and no part of the planet has been spared the effects of climate change. There is now a real belief among scientists, and increasingly the public, that our current industrial, trade, planning, energy, and food production systems are not sustainable, and that we have perhaps 10 to 15 years to change our trajectory to a more sustainable path. Those born in the last 25 years are living in a world that has been substantially changed from that of their parents. Many among the younger generation do not know a world that has not been already beset by exponentially worsening environmental issues. This ‘normalization’ of ecosystem degradation can create a pattern of behavior that can prevent real action to address cumulative environmental challenges. There is hope, though.

Greta Thunberg, the young Swedish climate change activist, has galvanized the younger generation to protest global inaction on climate change. Her actions, and those of regulators, industry, and civil society who are her allies, are drawing attention and measured action to mitigate climate change and the related environmental issues. Added to this are the remarkable effects that the COVID-19 pandemic has had on environmental quality indicators and the associated mechanisms of cumulative effects. Due to the shuttering of business and industry, and the resulting reduction of greenhouse gases and industrial pollution, people the world over have noticed phenomena that were previously unimaginable. The Venetian canals became blue and fish returned, the Himalayas were visible from the state of Punjab for the first time in 30 years, and people heard bird song for the first time in many cities. These experiences should not be ‘exceptional’; they should be normal. However, cumulative effects and our normalization of a degraded world have become an accepted reality. The COVID-19 pandemic has also dramatically highlighted how the cumulative effects of pollution negatively affect survival from a COVID-19 infection.

Worldwide, air pollution causes 7 million deaths annually, including premature deaths from asthma and chronic obstructive pulmonary disease (COPD), according to the World Health Organization (n.d.). Adding to this, Health Canada (2016) has concluded that fine particles from diesel exhaust, the components of smog, and other fossil fuel emissions damage people’s

immune systems and reduce their resilience to diseases, while studies by Harvard University determined that COVID-19 is more deadly where there is more air pollution and particulates from fossil fuels (Bowler, 2020). The cumulative effects of pollution and industrial emissions are lethal and add tremendous burdens on the world's health care systems. The COVID-19 crisis has been, in some surprising ways, a window to a cleaner, quieter, and healthier world less heavily burdened with cumulative environmental challenges, even if for a short time.

Coupled with the relationship between the cumulative environmental issues and health are growing geopolitical issues. For example, in Canada, over the next ten years it is expected that there will be over 500 billion dollars invested in the extractive sector (Dr. P. Oxhorn, personal communication, 2013). Over 50 per cent of these investments will happen on or very close to the First Nation, Métis, and Inuit lands of Canada. As cumulative effects of development negatively affect the culture, health, and livelihoods of Canada's Indigenous peoples through wild-life population decline, polluted water, and forest ecosystem changes, Indigenous peoples in Canada and the world over will accelerate and magnify their growing political voices to ensure their rights granted through legislation, customary law, and court decisions are respected, protected, and affirmed. For example, in the winter of 2020, Canada was embroiled in rail blockades in support of the Wet'suwet'en's First Nation opposition to a 500 km oil pipeline through their traditional territory. These sorts of actions will not subside unless environmental and land rights issues of First Nations are properly heard and acted upon. Cumulative effects issues are now shaping and influencing the foundations of responsible governance and have the potential to dramatically alter political directions and the social welfare of many countries.

We are keenly aware of these problems. The Earth is 'tweeting' daily about the degradation of its life supporting systems. The Stockholm Resilience Centre has identified nine planetary boundaries that sustain life. Three have now been exceeded: atmospheric carbon dioxide, phosphorus in soils and water, and declines in biodiversity. Like birds and fish that can change direction in milliseconds in response to a threat (harmonic convergence), we must ask whether humans are able to respond in time. There are positive indications we will: there are over 160 000 organizations in the world devoted to environmental protection; companies are discovering that respecting environmental boundaries is good for community relations; and business and governments in many parts of the world are pivoting to green economy paths.

Addressing cumulative effects in ways that put our civilization on a more sustainable path does not have to be as difficult as once imagined. Morris et al. (2020) have indicated that better management of areas with high levels of biomass and soil carbon could limit climate change. If just 50 per cent of these areas were managed in ways that respect ecosystem functions, more than 80 per cent of the land's total carbon stock could be prevented from entering the atmosphere. We now have the research to provide workable solutions that are achievable, that are economically, socially, and politically feasible, and that put us on to a more sustainable future.

This book is topical and extremely important. Much has been written on CIA over the last 40 years. This publication adds much to the understanding of the issues concerning CIA, and how to address this topic in a practical and effective way. The case studies give impact assessment practitioners from all sectors a clear road map on how to do CIA that is clearly no longer just an environmental topic, but is integrally connected to geopolitical, social, and economic sectors of society. The book has contributions from authors who are recognized thought and opinion leaders in the field of CIA. One of the authors, Dr. Peter Duinker from Dalhousie University, Canada, has been writing and doing research on CIA since the 1980s. His contribution, and the contributions of those with a similar breadth of knowledge and experience in

CIA, will advance the practice of CIA with lasting significance. They offer comprehensive overviews and analysis of CIA that can be used today to address the growing importance of safeguarding the planet's life supporting systems. We must change our industrial, energy, and transportation processes to avoid a dire future for our children. This publication is a serious, timely, and focused contribution to the research and practice of CIA that will lead people to act, and not just argue.

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