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## Environmental impacts of tobacco

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# The environmental and health impacts of tobacco agriculture, cigarette manufacture and consumption

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## Abstract

The health consequences of tobacco use are well known, but less recognized are the significant environmental impacts of tobacco production and use. The environmental impacts of tobacco include tobacco growing and curing; product manufacturing and distribution; product consumption; and post-consumption waste. The World Health Organization's Framework Convention on Tobacco Control addresses environmental concerns in Articles 17 and 18, which primarily apply to tobacco agriculture. Article 5.3 calls for protection from policy interference by the tobacco industry regarding the environmental harms of tobacco production and use. We detail the environmental impacts of tobacco life-cycle and suggest policy responses.

## Резюме

### Introduction

The human health impacts of tobacco use are well-documented. The World Health Organization (WHO) estimates that there will be more than 8 million tobacco-related deaths a year by 2030, amounting to 10% of annual deaths worldwide.<sup>1</sup>

The impact that tobacco has on the environment is less well recognized. The WHO Framework Convention on Tobacco Control (FCTC) addresses the environmental concerns regarding tobacco in Article 18, which states that:

“In carrying out their obligations under this Convention, the Parties agree to have due regard to the protection of the environment and the health of persons in relation to the environment in respect of tobacco cultivation and manufacture within their respective territories.”

In response, a series of policy options and recommendations were agreed at the sixth Conference of the Parties to the FCTC in 2014.<sup>2</sup> The meeting identified key sources of environmental concern and recommended environmental impact studies on tobacco growing.<sup>2</sup> Given the environmental and occupational health concerns associated with tobacco growing, the FCTC also addresses the need for alternative livelihoods for tobacco growers in Article 17.

The environmental lifecycle of tobacco can be roughly divided into four stages: (i) tobacco growing and curing; (ii) product manufacturing and distribution; (iii) product consumption; and (iv) post-consumption waste. Here, we describe the environmental and health concerns at each of these stages and propose recommendations for policy-makers.

### **Tobacco growing and curing**

In 2011, around 4 200 000 hectares of land were devoted to tobacco growing, representing less than 1% of total arable land globally; however, in several low- and middle-income countries, the percentage of arable land devoted to tobacco growing has recently increased.<sup>1</sup> For example, it has almost doubled in China, Malawi and United Republic of Tanzania since the 1960s. Deforestation for tobacco growing has many serious environmental consequences – including loss of biodiversity, soil erosion and degradation, water pollution and increases in atmospheric carbon dioxide.

Tobacco growing usually involves substantial use of chemicals – including pesticides, fertilizers and growth regulators.<sup>3</sup> These chemicals may affect drinking water sources as a result of runoff from tobacco growing areas. Research has also shown that tobacco crops deplete soil nutrients by taking up more nitrogen, phosphorus and potassium than other major crops. This depletion is compounded by topping and de-suckering plants, which increase the nicotine content and leaf yields of tobacco plants.<sup>3</sup>

Land used for subsistence farming in low- and middle-income countries may be diverted to tobacco as a cash crop. Intensive lobbying and investments by multinational tobacco companies (e.g. Philip Morris International, British American Tobacco and Japan Tobacco International) and leaf buyers (e.g. Universal Corporation and Alliance One International) along with market liberalization measures have encouraged the expansion of

tobacco agriculture in low- and middle-income countries. Many of these countries have limited legislative and economic capacities to resist multinational tobacco companies' influence and investments. As a consequence of expanded tobacco agriculture, there are short-term economic benefits for some farmers, but there will be long-term social, economic, health and environmental detriments for many others.<sup>4</sup>

Due to widespread concerns about unfair labour practices in tobacco agriculture, tobacco control advocates have recently been working with tobacco farmers and farm workers to ensure the right to collectively bargain and to receive living wages and fair leaf prices.<sup>5</sup> Given the agricultural labour practices in both low- and middle-income countries and more developed countries, attention is also needed to ensure the safety of children involved in tobacco farming. Farm workers, especially child labourers, minorities and migrant workers are at risk of nicotine toxicity (green tobacco illness), caused by handling tobacco leaves without protection during harvest and processing.<sup>6</sup>

### **Manufacturing and distribution**

In 1995, it was estimated that global tobacco manufacturing produced over 2 000 000 tonnes of solid waste, 300 000 tonnes of non-recyclable nicotine-containing waste and 200 000 tonnes of chemical waste.<sup>7</sup> If annual cigarette production had remained constant for the past 20 years (output has actually increased from 5 to 6.3 trillion cigarettes annually), tobacco factories would have deposited a total of 45 000 000 tonnes of solid wastes, 6 000 000 tonnes of nicotine waste and almost 4 000 000 tonnes of chemical wastes during this time. Other toxic by-products of tobacco manufacturing or chemicals used in manufacturing include ammonia, hydrochloric acid, toluene and methyl ethyl ketone.

### **Product consumption**

The health impacts of environmental tobacco smoke exposure include lung cancer, cardiovascular disease and pulmonary disease.<sup>8</sup> Exposure to residual chemicals in environments where smoking has taken place may also have human health impacts, though these impacts have not yet been quantified.<sup>9</sup> Most cigarettes are lit using matches or gas-filled lighters. If, for example, one wooden match is used to light two cigarettes, the six trillion cigarettes smoked globally each year would require the destruction of about nine million trees to produce three trillion matches.<sup>10</sup> There are also environmental impacts of manufacturing and disposing of the plastic, metal and butane used in making cigarette lighters.

Cigarettes remain an important cause of accidental fires and resulting deaths. In the United Kingdom of Great Britain and Northern Ireland, cigarettes caused 7% of fires in

2013–2014, making them the single most important cause of deaths related to fires (34 deaths/1000 fires).<sup>11</sup> In the United States of America, cigarettes have been responsible for 8–10% of all fires over the past 10 years (on average 90 000 fires per year); they also remain the single most important cause of deaths related to fires (540 of 2855 total deaths in 2011).<sup>12</sup> These fires were responsible for 621 million United States dollars in direct property damage and 1640 civilian injuries. Regulations requiring cigarettes to self-extinguish in Canada and the USA were associated with a 30% decline in fire-related deaths from 2003 to 2011.<sup>13</sup>

### **Post-consumption waste**

Cigarette butts are the most commonly discarded piece of waste globally and are the most frequent item of litter picked up on beaches and water edges worldwide.<sup>14</sup> The non-biodegradable cellulose acetate filter attached to most manufactured cigarettes is the main component of cigarette butt waste and trillions of filter-tipped butts are discarded annually. Assuming that each filter weighs 170 milligrams, the weight of all tobacco-attributable non-biodegradable (filter) waste discarded annually is about 175 200 tonnes.

Hazardous substances have been identified in cigarette butts – including arsenic, lead, nicotine and ethyl phenol. These substances are leached from discarded butts into aquatic environments and soil. Although the environmental impact of this waste has not yet been quantified, the large quantity of discarded butts may allow leachates to affect the quality of drinking water. Other post-consumption wastes, such as medicines, pesticides and plastic microbeads from cosmetics, have been found in drinking water sources.<sup>15–17</sup> It is possible that tobacco product waste may also prove to be a significant environmental contaminant and potential human health hazard through bioaccumulation in the food-chain.

With 6 trillion cigarettes manufactured annually, about 300 billion packages (assuming 20 cigarettes per pack) are made for tobacco products. Assuming each empty pack weighs about six grams, this amounts to about 1 800 000 tonnes of packaging waste, composed of paper, ink, cellophane, foil and glue. The waste from cartons and boxes used for distribution and packing brings the total annual solid post-consumption waste to at least 2 000 000 tonnes. This compares with an estimated 1 830 000 tonnes annually of plastic waste from mineral water bottles (estimation method available from the corresponding author).

Electronic cigarettes may contain batteries that require special disposal as well as chemicals, packaging and other non-biodegradable materials. The US Federal Emergency Management Agency (FEMA) has expressed concerns about the flammability and lack of product regulation of electronic cigarettes and their components.<sup>18</sup>

## **Carbon dioxide emissions**

Tobacco smoking leads directly to the emission of 2 600 000 tonnes of carbon dioxide and about 5 200 000 tonnes of methane.<sup>19</sup> Data from 66 low- and middle-income countries showed that tobacco growing and curing caused significant deforestation between 1990 and 1995, amounting to approximately 2000 hectares – on average, 5% of each country’s estimated deforestation during that five-year period.<sup>20</sup> Worldwide, approximately 13 000 000 hectares of forest are lost due to agriculture or natural causes each year,<sup>21</sup> and of this, at least 200 000 hectares are for tobacco agriculture and curing.<sup>1</sup> Deforestation is the second largest anthropogenic source of carbon dioxide to the atmosphere (approximately 20%), after fossil fuel combustion.<sup>22</sup> One estimate of the impact of deforestation in tobacco agriculture and curing is that it causes almost 5% of global greenhouse gas production.<sup>23</sup>

Despite their now well-known efforts to sow doubt among the public and policy-makers about anthropogenic climate change,<sup>24</sup> tobacco companies have advertised their efforts to reduce carbon emissions. British American Tobacco estimated in 2006 that production of one million cigarettes produces 0.79 tonnes of carbon dioxide. According to this estimate, 4 740 000 tonnes of carbon dioxide would be emitted annually by global cigarette manufacturing. Other analyses assert that this is a gross underestimate of the greenhouse gas burden due to tobacco growing, manufacturing and transport.<sup>23</sup> No estimates are as yet available on the extent of carbon dioxide emissions due to tobacco product transport.

## **Proposed next steps**

The FCTC recommendations encompass all aspects of the livelihoods of tobacco growers and workers – including health, economic, social, environmental and food security concerns.<sup>25</sup> The recommendations reemphasized the need to confront the vested interests of tobacco companies. These companies have promoted policies that avoid all environmental responsibility of the producer, and they attempt to divert public attention away from their environmental responsibilities through corporate social responsibility programmes.<sup>26</sup> Protecting the public against the tobacco industry’s environmental impact is aligned with FCTC Article 5.3 and its guidelines, which remind Parties that: “There is a fundamental and irreconcilable conflict between the tobacco industry’s interests and public health policy interests.”<sup>27</sup> The FCTC recommendations also propose conducting an analysis of the main barriers and existing opportunities for Article 18 implementation.<sup>2</sup>

A community of concern needs to be established among multiple sectors – including health, agriculture, trade and environment – to address the environmental impacts of tobacco

production and use. The FCTC Parties may consider such a broad approach as a new way to include academia, nongovernmental organizations and non-party countries. It is clear that tobacco control intersects with other pressing global issues such as sustainable development, environmental policy, climate change, trade agreements and human rights. By taking broad-based but effective action against the hazards created by the tobacco industry, the demand for tobacco products will be further reduced. With strengthened environmental policies, there will be increased costs for tobacco products, decreased social acceptance of tobacco use and changes in the most commonly used tobacco products.

Policy options and recommendations on alternatives to tobacco growing involve comprehensive, environmentally-oriented tobacco control interventions for both tobacco growing and non-growing countries. We propose seven recommendations for Parties to the FCTC to consider. First, identify, prevent, treat and monitor health effects related to tobacco growing among farmers and workers. Second, develop strategies to free tobacco farmers and especially their children from unfair and unsafe agricultural and labour-related practices. Third, strengthen regulation of tobacco agriculture to prevent deforestation and land degradation. Fourth, implement extended producer responsibility regulations on the tobacco industry to reduce, mitigate and prevent manufacturing and post-consumption tobacco product waste. Fifth, extend tobacco product sales regulation to eliminate single-use filters – including any non-biodegradable varieties – to reduce post-consumption waste. Sixth, engage litigation and economic interventions to recover the costs of industry misconduct and environmental damages. Seventh, innovate, improve and enforce new and existing environmental regulations and agreements that may apply to tobacco manufacturing, transport and management of post consumption waste.

**Competing interests:**

None declared.

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