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**Review Article**

# Environment and its protection from tobacco: a step towards tobacco end game, a perspective from India

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## ABSTRACT

The planet is facing numerous environmental concerns. Healthy soil, an appropriate quantity of clean and fresh water, and clean air are just a few of the basic essentials that allow humanity to survive, but are being stressed by rising populations and human demand for the earth's valuable resources. Tobacco-related processes are harmful to the environment, from cultivation to manufacture, distribution, product usage, and post-consumer trash. The tobacco industry's adverse influence on deforestation, climate change, and waste production is huge and expanding, and until now, these components of the tobacco control picture have received very little attention from researchers and policymakers. According to article 18 of the World Health Organization's (WHO) "framework convention on tobacco control (FCTC)," ratifying parties are required to give due consideration to environmental protection and the general well-being of people in relation to tobacco farming and production within their respective territories. Instead of focusing on controlling the tobacco epidemic, national and international discussions have centered on this idea to end it, which has sparked relatively longer-term strategy. Globally many countries including New Zealand, Scotland, United Kingdom, Ireland, United States of America, Canada, Australia, Sweden, Finland as well as India (third largest tobacco producer nation in the world) have already adopted various initiatives to adhere with end game strategy. This paper investigates the environmental impact of tobacco and its various other detrimental effects on health of living beings', as well as the "tobacco end game" approach to not only control the epidemic but also create a "tobacco-free world".

**Keywords:** Tobacco farm, Tobacco farming, Forest, Health, India

## INTRODUCTION

The fact that most people are now cognizant of smoking is a triumph for global health and well-being. However, success in reducing tobacco's health effects has not been matched by accomplishment in challenging tobacco's other effects, such as on education, equality, economic expansion, and the environment, all of which can have a repercussion on a country's development.[1] Nicotine is a highly addictive component of tobacco, and smoking contributes significantly to cancer, cardiovascular and respiratory illnesses, as well as a host of other disabling health conditions. The tobacco epidemic, which results in the annual decapitation of more than 8 million people, is one of the greatest threats to global public health. Nearly 1.2 million of these deaths are attributed to nonsmokers being passively exposed to smoke, while more than 7 million are directly caused by tobacco use.[2] There were 1.14 billion regular smokers in the world in 2019, who burned 7.41 trillion cigarette equivalents of tobacco. Globally, about one third of men 32.7% (32.3–33.0) and about 6.62% (6.43–6.83) of women aged ≥15 years use tobacco.[3]

Currently, tobacco is a significant cash crop in the nation, grown on 0.4 million hectares, or about 0.27% of the net cultivated area. After China and Brazil, India produces about 700 million kg annually, placing it third in the world.

The majority of Indian Union states grow some type of tobacco, which has a significant impact on the industry, the farming community's economic growth and prosperity.[4] India's major tobacco manufacturing states are Gujarat, Andhra Pradesh, Uttar Pradesh, Karnataka, West Bengal, Telangana and Bihar. Out of these Gujarat, Andhra Pradesh and Uttar Pradesh account for around 45%, 20% and 15% of the country's total production respectively. Karnataka accounts for around 8% and rest of the state's account for about 2-3% of the country's total tobacco production.[5]

During 2021-2022, India exported Flue Cured Virginia (FCV) tobacco amounting to 1.11 lakh tonnes. The value of the total FCV tobacco exports during 2021-22 was Rs. 2,858 crore (US$ 359 million). Millions of people in India depend on the sale of tobacco for their livelihood, both on and off farms, and it provides significant employment opportunities. The Central Tobacco Research Institute (CTRI), Andhra Pradesh estimates that approximately 6 million farmers and 20 million farm laborer's work in tobacco farming across 15 states in India. Bidi rolling employs 4.4 million people, with another 2.2 million tribal employees engaged in tendu collection (leaf used to roll bidi).[5]

As a result, tobacco is significant as a crop, an exportable product, and revenue source and foreign exchange earnings for the government. The net gain or loss to the government due to disability, disease, and death from tobacco use has not, however, been accurately and thoroughly quantified. The negative health effects that tobacco farmers, farmworkers, and bidi workers must deal with go unnoticed by millions of them. Not only health related problem but also the environmental problem generated by each stage of tobacco life cycle is a serious concern. The agricultural impacts of cultivating tobacco, various negative consequences of manufacturing and distributing tobacco – from the use of fossil fuels to the production of hazardous waste, environmental damage caused by the immediate consumption of tobacco products are the matter of great concern. To deal with the menace in 2003, the World Health Organization framework convention on tobacco control (WHO FCTC) has addressed in article 17 about the support for economically viable alternative activities and in article 18 the protection of the environment and the health of persons.[1]

In this paper, the author has reviewed the literature on tobacco's effects on the environment and to summarize its findings and knowledge gaps. This overview compiles known information on how tobacco impacts human well-being from an environmental standpoint as well as the end game strategy for making a tobacco free world.

## METHODS

Different from a typical systematic review, more care was taken to find the most pertinent articles that fit the specific objective when searching the literature than the broadness of the available evidences. The comprehensive literature search was performed for published peer reviewed articles using multiple electronic databases as PubMed, Google scholar, science direct and Directory of Open Access Journal (DOAJ) by using the keywords like "tobacco farm and environment", "tobacco farm and forest", "tobacco farming and health", "tobacco farming and India". Newspapers, organizational reports, and government documents were also used to gather documented evidence. Studies that were both published in English and pertinent to the subject of the paper only met the inclusion criteria.

## DISCUSSION

It is crucial to comprehend how tobacco affects the environment for a number of reasons. These include the fact that it allows us to assess some of the risks associated with tobacco production that are currently excluded from tobacco mortality estimates (such as poor air quality and pesticide use), as well as its broader impact on development, including economic stability, food security, and gender equality. The discussion covers all steps, from producing and curing tobacco leaves to manufacturing and distributing tobacco products; and from the effects of lighting and consuming tobacco to the waste products generated after consumption, such as smoke, discarded butts, and packaging.

### *Life cycle of tobacco*

Tobacco's life cycle impacts can be loosely separated into five critical stages: growing and curing; product manufacture; distribution and transportation; product use, including second-hand and third-hand smoke exposure; and disposal of post-consumption tobacco product trash (Figure 1).

### *Growing and curing*

#### *Deforestation*

In India, around four million hectares of land are used for tobacco production, which also accounts for 4%, of yearly global deforestation.[6] As a thumb rule, one hectare of forest wood is required to cure half hectare of tobacco crop. At this rate, 4,00,000 hectre of forest is being depleted every year for tobacco curing.[7] Numerous negative environmental effects of deforestation for tobacco farming include ecological damage, soil degradation and erosion, water contamination, and a rise in greenhouse gases in the atmosphere.[8] According to a study, the proportion of tobacco output in Asia and Oceania has steadily increased from around 30% in the 1950s to around 63% now. As a result, Asia/Oceania has the highest percentage (3.7%) of tobacco-related forest removal among the continents.[9] The loss of animal and plant species due to their loss of habitat is one of the most hazardous and distressing results of deforestation. Forests are home to 70% of all land animals and plant species. The trees also help to manage the amount of water in the atmosphere by

regulating the water cycle. There is less water in the air to return to the soil in deforested areas. This results in drier soil and an inability to cultivate crops. Soil erosion and coastal flooding are two more consequences of deforestation. Trees aid in the retention of water and topsoil, which offers the rich nutrients required to sustain new forest life. As enormous areas of forest are cut, enabling exposed ground to wilt and die and destroying the habitats of numerous species, indigenous communities that live there and rely on the forest to preserve their way of life are also threatened.[10]

*Agrochemical use*

Tobacco is frequently farmed without crop rotation (as a monocrop), leaving the tobacco plants and soil exposed to a range of pests and illnesses. Pesticides (insecticides, herbicides, fungicides, and fumigants) and growth regulators (inhibitors and ripening agents) are used on tobacco plants at various phases of development.[11] Tobacco plants necessitate the application of chemical fertilizers in addition to insecticides and growth regulators and these chemicals are usually applied without any protective equipment make the farmers vulnerable to various adverse effect.

*Tobacco cultivation and greenhouse gas emissions*

Along with the habitat loss, a lack of trees also makes it possible for more greenhouse gases to be emitted into the sky. A healthy forest serves as a valuable carbon sink by absorbing carbon dioxide ($CO_2$) from the atmosphere. That capability is lost in deforested areas, and more carbon is released. Tobacco curing creates $CO_2$ emissions and air pollution. India, which manufactured 10,000 million cigarettes in 2010, is projected to have emitted roughly 6750 tonnes of $CO_2$ to create cigarettes.[7]

***Cigarettes and other tobacco product manufacture***

*Cigarettes*

Cigarette butts and other tobacco waste make up the largest number of individual pieces of litter in the world. Cigarette and bidi butts are concentrated toxic waste dumps that contribute to toxic waste issues. Cigarette filters are made of cellulose acetate, a type of plastic that is resistant to biodegradation and can last for generations in the environment. These butts consist of un-smoked remnant tobacco, the filter of cigarettes and paper wrap. When discarded carelessly, it leaches out toxic chemicals in the environment, thus contaminating it with heavy metals and over 4,000 poisonous chemicals like nitrosamines, polycyclic aromatic hydrocarbons, nicotine and many more. It also has an impact on marine and aquatic animals. Cigarette and bidi butts are a common cause of forest and residential fires, posing a hazard to life, property, and forest areas (Figure 2).[7]

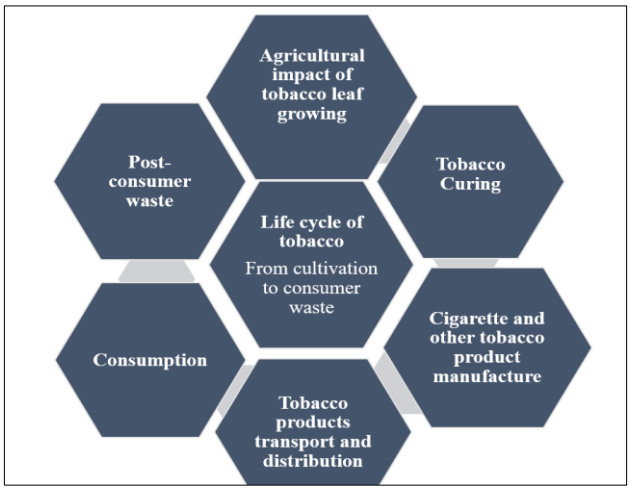


**Figure 1: Life cycle of tobacco.[1]**

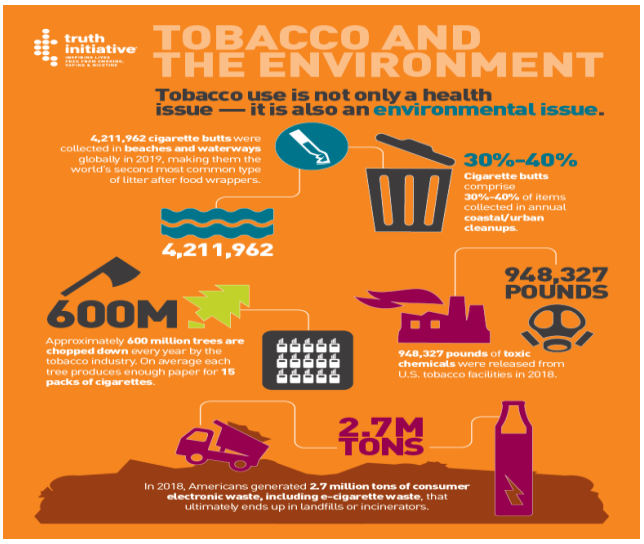


**Figure 2: Tobacco and its waste products (source-Tobacco and environment. Truth initiative).**

*E-cigarettes*

E-cigarette-related waste could pose a greater environmental hazard than cigarette butts because it incorporates metal, circuitry, single-use plastic cartridges, batteries, and toxic chemicals in e-liquids. Unlike cigarette butts, e-cigarette waste won't biodegrade even under severe conditions. E-cigarettes left on the street eventually break down into microplastics and chemicals that flow into the storm drains to pollute our waterways and wildlife.

*Smokeless tobacco*

The plastic wrapper of smokeless tobacco poses a serious threat to environment as because these plastics are not biodegradable and it remains intact year after year. People who use smokeless tobacco spit everywhere, making the area unclean and contaminated, posing a severe threat to the ecosystem.

***Tobacco products transport and distribution***

According to the WHO, one of the leading causes of disease-related air pollution is truck traffic.[13] According to a recent study, ambient outdoor air pollution induces faster calcium deposition in arteries, which can increase the risk of heart attacks and strokes and the incidence of arteriosclerosis by 10–20%.[14]

***Consumption***

Mainstream and sidestream smoke- tobacco smoke is a complex mixture of thousands of chemical components suspended in the atmosphere as gases and minuscule droplets.[15] Mainstream smoke is emitted at the filter end of a cigarette when a smoker draws air through the burning cigarette to inhale, and the tobacco burns at a high temperature (up to 950 $^0$C) due to the increased supply of oxygen. In comparison, sidestream smoke is produced between puffs and is released at the smouldering tip of the cigarette at a lower temperature (600–800 $^0$C). As an example, sidestream smoke includes 147 times more ammonia, 16 times more pyridine, 15 times more formaldehyde, 12 times more quinolone, three times more styrene, and twice as much nicotine than mainstream smoke.[1] Sidestream smoking is two to six times more cancerous and four times more hazardous than mainstream smoke when inhaled fresh.[16]

***Post-consumer waste***

Each year, the world produces between 340 and 680 million kg of waste tobacco products, with up to two-thirds of each smoked cigarette being dumped onto the ground. However, the issue is not just with the quantity of this waste. Additionally, the waste from tobacco products contains over 7000 hazardous compounds, including known human carcinogens, which seep into the environment and build up over time.[1] Currently, neither tobacco product manufacturers nor consumers are responsible for paying the costs of cleanup and disposal, which is an unsustainable arrangement. There are other waste products connected to tobacco usage in addition to trash, such as the 2 million tons of paper, ink, cellophane, foil, and glue used in wrapping for tobacco goods. This debris ends up anywhere, in our waterways, sewers, and other aquatic ecosystems in addition to our streets.

***Green tobacco sickness (GTS)***

Workers who cultivate, grow, and harvest tobacco are susceptible to "green tobacco sickness," a type of nicotine poisoning. Nicotine is a substance that can enter the circulation through the skin and cause GTS. When nicotine dissolves in precipitation, dew, or sweat, absorption is more likely. Vomiting and nausea brought on by this condition might result in hospitalization and time away from work. Workers in the tobacco industry who have green tobacco sickness are more susceptible to heat disease, a potentially fatal condition.[17]

***Economic burden***

Numerous factors can impede economic development caused by tobacco. The financial repercussions of tobacco use are large and include high medical expenses for treating diseases brought on by tobacco use as well as the lost human resources as a result of morbidity and mortality linked to tobacco addiction. Several countries that are large tobacco producers are also food insecure. A study conducted in Canada, 2021 revealed that Food insecure individuals prioritized purchasing non-nutritious foods, alcohol, and tobacco over food secure participants.[18]

## CONCLUSION

Globally, an increasing number of countries are taking steps to end the tobacco epidemic. To accomplish and reach this goal, many initiatives are being performed and planned across nations, all under the umbrella of the "tobacco endgame".[21] The “tobacco endgame” concept proposes a transition from tobacco control (which supposes the constant existence of tobacco as a common, widely available, ordinary consumer product) to a tobacco-free future in which commercial tobacco products are phased out or their use and affordability are substantially constrained.[22] The focus of this strategy lies behind the concept to create a tobacco-free generation, which promotes prohibiting the sale and supply of tobacco to people born after a specified year. This proposal came into effect in 2010 since then it has garnered global attention and support. It is high time to take essential steps to improve the current situation by implementing and monitoring the adherence to guidelines. All the stakeholders like government, police personnel, tobacco company, shopkeeper selling tobacco products, are needed to be sensitized to protect citizens' and the environment's health. The government should speed up the transition from tobacco cultivation, processing, and manufacturing to healthier alternatives. Initiatives that should have gotten more attention and approval haven't because consumers, lawmakers, and even smokers don't fully understand the damage tobacco causes to people's health and the environment. Perhaps the most crucial thing to do is to raise awareness of this. In the end, every effort will bring us one-step closer to ending tobacco use and ensuring that the next generation is smoke-free.

***Recommendations***

*Policy level*

The WHO FCTC is the first international treaty in response to the globalization of the tobacco epidemic. Although India played a leading role to finalize its provisions and was the regional coordinator for the South-East Asian countries but still now there is a widespread violation observed.

The "part V: protection of the environment" section of the WHO FCTC clearly addresses the environmental

ramifications of tobacco use, albeit it is not the only section that pushes for a more responsible environmental approach. Within the WHO FCTC there are a number of articles that could play an important role in educating the public and in reducing the harm caused by short- and long-term consequences of the tobacco use life cycle.

According to the WHO FCTC article 17 i.e. (provision of support for economically viable alternative activities) we need to create more robust strategies for farmers to take alternate farming without creating any loss for their earning. To prevent deforestation and land damage, tobacco agriculture should be more strictly regulated.

Producer responsibility is a huge matter in policy level approach. Legislation determines the scope of liability, which may include various stages of the product's life cycle, such as consumption and final disposal. The producer bears some or all of the costs associated with the collection, recycling, or final disposal of the manufactured goods. The manufacturer must provide information on the environmental dangers of the manufactured products.

Tobacco taxes are the most cost-effective strategy in many nations to curb tobacco use and health-care expenses, particularly among youth and low-income individuals, while increasing revenue. Tobacco price increases of 10% reduce tobacco consumption by roughly 4% in high-income nations and by 5% in low- and middle-income countries.[19]

Develop, modify, and implement new and current environmental standards and treaties that may applicable to tobacco manufacturing, transportation, intake, and waste disposal.

*Individual level*

MPOWER is a policy package (2007) designed to help countries implement effective tobacco-reduction programmes authorized by the WHO FCTC. The six MPOWER measures are: monitor tobacco use and prevention policies; protect people from tobacco use; offer help to quit tobacco use; warn about the dangers of tobacco; enforce bans on tobacco advertising, promotion and sponsorship; and raise taxes on tobacco (Figure 3). By adhering these strategies one nation can regulate the demand, production and utilisation of tobacco products among the population.[20]

In the year 2021 World No Tobacco Day theme -"Commit to quit" - was an opportunity to emphasize the importance of quitting and to encourage countries, health systems, and public and private organizations to assist the world's 1.3 million tobacco users to quit. Smoking cessation quit lines and smoking cessation treatments are also more popular as a result of anti-tobacco mass media efforts.

Another approach "tobacco free educational institutions (ToFEI)" countries should implement to curb the tobacco use among youth who are the major market for tobacco industry. At the level of educational institutes, adhering the guidelines of tobacco-free educational institutions provide opportunities for tobacco prevention and control among students by attempting to address the informational needs, ensuring that existing regulations are followed and modifying the school's organizational climate to eliminate tobacco use. For avoiding teenage tobacco use and ensuring a smoke-free society, these rules must be implemented consistently and strictly in every school.


**Figure 3: Environment and its protection from tobacco-a step towards tobacco end game.**

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