CONVENTION ON INTERNATIONAL TRADE IN ENDANGERED SPECIES
OF WILD FAUNA AND FLORA

Seventy-third meeting of the Standing Committee
Online, 5-7 May 2021

Interpretation and implementation matters

Exemptions and special trade provisions

STOCKS AND STOCKPILES (ELEPHANT IVORY): REPORT OF THE WORKING GROUP

1. This document has been submitted by the European Union as Chair of the Standing Committee intersessional working group on guidance on ivory stockpiles.*

2. At the 18th meeting of the CITES Conference of the Parties, Decision 18.182 was adopted, which requested the Standing Committee, at its 73rd meeting (SC73) to "review and consider for approval the practical guidance prepared by the Secretariat for the management of ivory stockpiles, including their disposal".

3. At the 72nd meeting of the CITES Standing Committee, an intersessional working group on guidance on ivory stockpiles was established. The members for this working group were agreed as follows: Botswana, Canada, China, Democratic Republic of the Congo, Ethiopia, European Union (Chair), Gabon, Israel, Japan, Kenya, Malaysia, Mozambique, Namibia, Nigeria, South Africa, Uganda, United Arab Emirates, th United Kingdom of Great Britain and Northern Ireland, United Republic of Tanzania, United States of America and Zimbabwe; African Union Commission, International Union for Conservation of Nature; Animal Welfare Institute, Born Free Foundation, Center for Biological Diversity, China Wildlife Conservation Society, Conservation Alliance of Kenya, David Shepherd Wildlife Foundation, Environmental Investigation Agency USA, Elephant Protection Initiative Foundation, Fondation Franz Weber, International Fund for Animal Welfare, Ivory Education Institute, Jonathan Barzdo, Natural Resources Defense Council, Pro Wildlife, Stop Ivory, TRAFFIC, Wildlife Conservation Society, World Wildlife Fund and Zoological Society of London.

Background

4. Discussions on the topic of management of ivory stockpiles were initiated at SC65 and can be found in document SC65 Doc. 42.7. At CoP18, the Secretariat reported on the development of practical guidance (document CoP18 Doc. 69.1). A report on best practices for the disposal of elephant ivory stockpiles was under preparation by the Secretariat. Three documents on the management of stockpiles were already made available for the use of the Parties on the CITES-website without however specifically having been endorsed or recommended by the CoP or the Secretariat (https://cites.org/eng/imp/ivory_stockpile_mgmt.html).

5. Resolution Conf. 10.10 (Rev. CoP18) on *Trade in elephant specimens* urges Parties in whose jurisdiction there is an ivory carving industry, a legal domestic trade in ivory, an unregulated market for or illegal trade in ivory, or where ivory stockpiles exist, and Parties designated as ivory importing countries, to maintain an inventory of government-held stockpiles of ivory and, where possible, of significant privately held stockpiles of ivory within their territory, and inform the Secretariat of the level of this stock indicating the number of

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* *The geographical designations employed in this document do not imply the expression of any opinion whatsoever on the part of the CITES Secretariat (or the United Nations Environment Programme) concerning the legal status of any country, territory, or area, or concerning the delimitation of its frontiers or boundaries. The responsibility for the contents of the document rests exclusively with its author.*

pieces and their weight per type of ivory (raw or worked); for relevant pieces, and if marked, their markings in accordance with the provisions of this Resolution.

Discussion

6. After an initial discussion on the form this practical guidance should take, it was concluded to have one guidance document providing best practices on how to manage ivory stockpiles. Members of the working group also highlighted the fact that each Party has a specific situation with regard to its ivory stockpile and some discretion should be left to each Party to fill in the details on how they manage their stockpiles, within the boundaries of the provisions provided in Res. Conf. 10.10 (Rev. CoP18). This consolidated guidance should list the most important attributes of an effective system, detailing the goals of such a system whilst providing links to further tools available for Parties to use.

7. A first draft was prepared by the Secretariat, based on the material that was already available on the website. This document, as well as a separate document detailing options for the disposal of ivory, was shared with the working group. After several rounds of consultations and revising of the documents, a final version of the document “Practical guidance on ivory stockpile management” (annex 1) as well as the document “Review of Elephant Ivory Destruction Methods” (annex 2) was made available.

8. Both documents were supported by the members of the working group. However, two Parties as well as a group of Observers made it clear that they are concerned about language in the “Review of Elephant Ivory Destruction Methods” which suggests the possibility of selling the end products after sufficient pulverisation of ivory due to the high calcium and phosphate content of such end products. Furthermore, the same group of Observers would have preferred the guidance document being more comprehensive by including more detailed reference to the content of the documents to which the “Practical guidance on ivory stockpile management” now refers to.

Recommendations

9. The Standing Committee is requested to review and consider for approval the two documents “Practical guidance on ivory stockpile management” and “Review of Elephant Ivory Destruction Methods”.

10. The WG requests the Standing Committee to consider a periodic review of the available management tools, including but not limited to new destruction methods, which would allow the practical guidance to be a living document that will take into account new techniques and technologies and will continue to help Parties to implement Res. Conf. 10.10 (Rev. CoP18) in the future. This could initially be done via a decision at CoP19 requesting the Secretariat to issue a Notification prior to CoP20, requesting input from Parties on whether or not there is new information that should be considered by the Standing Committee for incorporation in the guidance document or any of the documents which are referred to in the guidance document. This decision could be continued at subsequent CoPs, or if considered to be of a long-term nature, could eventually be integrated into Res. Conf. 10.10 (Rev. CoP18) in the future.

Practical guidance for the management of ivory stockpiles, including their disposal

INTRODUCTION

Accumulations of elephant ivory will occur in many Parties due to confiscation of illegally possessed or traded (both internationally and nationally) ivory. In range States, accumulations will also occur due to found ivory resulting from natural mortality and from illegally killed elephants where the tusks have not been removed by the perpetrators.

In relation to confiscated and accumulated dead specimens of Appendix-I species such as elephants, Resolution Conf. 17.8 on *Disposal of illegally traded and confiscated specimens of CITES-listed species* recommends that they be disposed of "only for *bona fide* scientific, educational, enforcement or identification purposes, and save in storage or destroy specimens whose disposal for these purposes is not practicable".

The demand for ivory for scientific, educational, enforcement or identification purposes being limited, storage or destruction are often the options chosen by Parties.

In relation to ivory that is stored, Resolution Conf. 10.10 (Rev. CoP18) on *Trade in elephant specimens, paragraph 7 e)* urges Parties to maintain an inventory of government-held stockpiles of ivory and, where possible, of significant privately held stockpiles of ivory within their territory.

In paragraph 2 of the Resolution, the Conference of the Parties recommends that whole tusks of any size, and cut pieces of ivory that are both 20 cm or more in length and one kilogram or more in weight, be marked by means of punch-dies, indelible ink, or other form of permanent marking, using the following formula: country-of-origin two-letter ISO code, the last two digits of the year / the serial number for the year / and the weight in kilograms (e.g. KE 00/127/14). It is recognized that different Parties have different systems for marking and may apply different practices for specifying the serial number and the year (which may be the year of registration or recovery, for example), but that all systems must result in a unique number for each piece of marked ivory. This number should be placed at the 'lip mark', in the case of whole tusks, and highlighted with a flash of colour;

In Resolution Conf. 10.10 (Rev. CoP18), paragraph 7 e), Parties are further urged to inform the Secretariat of the level of this stock each year before 28 February indicating the number of pieces and their weight per type of ivory (raw or worked); for relevant pieces, and if marked, their markings in accordance with the provisions of this Resolution; the source of the ivory; and the reasons for any significant changes in the stockpile compared to the preceding year. This information is made available to the Monitoring the Illegal Killing of Elephants (MIKE) and the Elephant Trade Information System (ETIS) for their analyses.

To facilitate the submission of this information, the Secretariat has prepared a model inventory for the declaration of an ivory stock.

In order to comply with the above-mentioned requirements of Resolution Conf. 10.10 (Rev. CoP18) and to ensure that stored ivory does not find its way into illegal international trade and that samples are available for forensic research and in support of investigations and prosecutions, effective ivory stockpiles management systems are required. Should Parties decide to destroy their ivory stockpiles, or part of them, consideration needs to be given to the best means of achieving this cheaply, efficiently and limiting environmental side-effects.

It should be noted that Resolution Conf. 10.10 (Rev. CoP18) directs the Secretariat to identify those Parties where ivory stockpiles are not well secured and report its findings and recommendations to the Standing Committee, which may recommend remedial measures to support the implementation of the Resolution, including requesting identified Parties to develop and implement a National Ivory Action Plan, if deemed necessary by the Standing Committee.

KEY ATTRIBUTES FOR EFFECTIVE IVORY STOCKPILES MANAGEMENT SYSTEMS

Many Parties already have national ivory stockpile management systems in place, and these may be satisfactory for responding to the requirements set out in Resolution Conf. 10.10 (Rev. CoP18). However, for those Parties establishing ivory stockpile management systems or reviewing existing systems, the following table of key attributes and links to more detailed guidance may be of assistance. Within the stockpile management, it is crucial to have Standard Operating Procedures (SOPs) in place for the handling and tracking of ivory through the entire chain of custody, including the identification of staff responsible for security and accountability of the ivory stocks.

More detailed discussion on the background to stockpile management generally and ivory stockpiles in particular can be found in a report by TRAFFIC which is posted on the CITES website.

Attribute	**Sources of more detailed explanations and examples**
1. Legal mandate for stockpile management	The consolidation, maintenance, management, disposal or destruction of Government-controlled stockpiles need to be undertaken by an authority with a clear legal mandate under national law to undertake the activity in question. The authority concerned may vary from Party to Party and may be split between different authorities responsible for the various actions listed above. An absence of legal authority for these actions may result in an incoherent policy which could jeopardize the security of the stockpile maintenance and compromise law enforcement or judicial activities. Further guidance: Milliken T. and Compton J., Ensuring Effective Stockpile Management: A Guidance Document
2. Attribution of roles and responsibilities	Authorities with a legal mandate for either the consolidation, maintenance, management, disposal or destruction of Government-controlled stockpiles need to ensure that they have an operational protocol for discharging their responsibilities (see Standard Operating Procedures below). This needs to attribute roles and responsibilities for individual actions and staff accountability for ensuring that these are adhered to during every step in the chain of custody. Without proper attribution of roles and responsibilities, the security of the stockpile could be at risk. Further guidance: Milliken T. and Compton J., Ensuring Effective Stockpile Management: A Guidance Document
3. Standard Operating Procedures (SOPs) for stockpile Management, which should include e.g.	Quality management principles, e.g. ISO 9001 l
a. Ivory stock inventory	All ivory stockpiles should be fully inventoried to enable an accurate and real-time record of stocks held to be available at all times. If stock is held at more than one physical site, records need to be maintained of all transfers between sites. An accurate contemporary inventory is an essential prerequisite for stockpile management. An audit process should be set-up to ensure accuracy of the stockpile data. Further guidance: Elephant Protection Initiative. Protocol for Planning and Conducting Ivory Inventories Elephant Protection Initiative. Stockpile Management System (SMS) Elephant Protection Imitative. The Best Practices and Gold Standards for the Management of Ivory (and other wildlife products)

Attribute		Sources of more detailed explanations and examples
b.	Inter-agency collaboration	If more than one authority is involved in consolidation, maintenance, management, disposal or destruction of Government-controlled stockpiles, then regular coordination is needed between them, preferably using a shared SOP. This includes national and local authorities where the administrative organization of the Party requires involvement at both levels of government. Further guidance: Milliken T. and Compton J., Ensuring Effective Stockpile Management: A Guidance Document
c.	Data management and reporting	Ideally, ivory inventories should be digitized using secure software and managed by qualified staff. This reduces the scope for security breaches and improves the accuracy and timeliness of statistics. Annual transmission of the level of a stock is to be made available before 28 February, including the minimal information as indicated in Res. Conf. 10.10 (Trade in elephant specimens) Further guidance: Milliken T. and Compton J., Ensuring Effective Stockpile Management: A Guidance Document
d.	Security during transport and at storage facilities	Security at all localities holding part or all of the Government-controlled stockpile as well as during any transport of ivory to and from a stockpile is paramount. The SOP should specify staffing responsibilities and physical mechanisms required to keep the stockpile secure at all times including during transit from one locality to another. Further guidance: Milliken T. and Compton J., Ensuring Effective Stockpile Management: A Guidance Document Elephant Protection Imitative. The Best Practices and Gold Standards for the Management of Ivory (and other wildlife products)
e.	Storage staff capacity-building	Staff involved in security, management, handling and record-keeping related to ivory stockpiles need to be adequately trained to undertake their duties competently and cleared of any conflict of interest. Further guidance: Milliken T. and Compton J., Ensuring Effective Stockpile Management: A Guidance Document
f.	Marking system	Ivory in stockpiles needs to be marked in accordance with national law and international standards as adopted by the Conference of the Parties to CITES. Details of the marking need to be integrated into the inventory. Further guidance: Paragraph 2 of Resolution Conf. 10.10 (Rev. CoP18)
g.	Sampling	Stockpiles containing confiscated ivory should be accessible for scientific and/or forensic sampling and testing of such ivory, in line with Res. Conf. 10.10 (Trade in elephant specimens). Further guidance: Milliken T. and Compton J., Ensuring Effective Stockpile Management: A Guidance Document Elephant Protection Initiative. Protocol for Planning and Conducting Ivory Inventories UNODC's *Guidelines on Methods and Procedures for Ivory Sampling and Laboratory Analysis*
h.	(if opted for) destruction procedure	If destruction of ivory stockpiles is envisaged, appropriate techniques should be used to ensure that ivory does not re-enter illegal trade. The national inventory should be used to carefully record which ivory should be and has been destroyed. Further guidance: Secretariat Review of Elephant Ivory Destruction Methods [hyperlink awaited]

Attribute	Sources of more detailed explanations and examples
4. Financing the stockpile management system	The cost of storage infrastructure, staffing and routine running costs, data management, marking and possible destruction may be significant. Options chosen for these should be commensurate with funds available, particularly recurring costs, as a breakdown in procedures could allow ivory to re-enter illegal trade. Further guidance: Milliken T. and Compton J., Ensuring Effective Stockpile Management: A Guidance Document

Review of Elephant Ivory Destruction Methods
CITES Secretariat[1]

Table of Contents

1. Introduction

In 1989, international commercial trade in elephant ivory was banned by the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

Poaching of elephants and illegal trade in their ivory however continues to impact global elephant populations, resulting in their decline. Since 1989, there were many events of ivory destruction around the world, involving more than 263 metric tons of ivory that have been destroyed in at least 21 countries and territories.[1]

In accordance with the guidance provided by Resolution Conf. 17.8 on *Disposal of illegally traded and confiscated specimens of CITES-listed species,* confiscated and accumulated dead specimens of Appendix-I species such as elephant ivory should be disposed of "only for *bona fide* scientific, educational, enforcement or identification purposes, and save in storage or destroy specimens whose disposal for these purposes is not practicable".

The purpose of this document is to review destruction methods.

In recent years, CITES Parties have increasingly used ivory destruction to discourage the illegal ivory trade. This report considers seven approaches to elephant ivory destruction and evaluates each in terms of its practical advantages / disadvantages and overall environmental impact. CITES Parties have used some of these approaches in the past, others have not. The report does not include an economic assessment of each approach.

Prior to any destruction of ivory stockpiles, Parties should take account of any recommendations of the Conference of the Parties concerning the collection of samples for forensic research and collaborating with relevant forensic research institutions. If any ivory to be destroyed has been marked, either in accordance with recommendations from the Conference of the Parties or national law, these marks should be recorded as this information may be useful for the purposes of law enforcement cooperation at a later date.

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[1] Based on a report by Jack Caravanos, DrPH, CIH, New York University, School of Global Public Health, New York, New York.

2. Background: Chemistry and Physical Properties of Ivory

Destruction techniques are often influenced by the chemical and physical properties of the material to be destroyed. The ivory tusks of an elephant are essentially the incisors that grow in the nasomaxillary complex of bones throughout its entire life.[2] The major bulk of ivory is dentine which is composed of inorganic and organic fractions.[3] The organic composition has a diamond-shaped pattern, better known as Schreger structure, which can be observed on the cross-section of elephant ivory.[3] This structure is a unique configuration of dentinal tubules, which is a type of organic fiber.[3] These organic fibers have diameter ranges from 0.8 to 2.2 microns and provides high elasticity to the ivory tusk.[3] The inorganic component of the dentine is dahllite, a form of calcium phosphate carbonate with the chemical formula; $Ca_{10}(PO_4)6(CO_3)H_2O$.[4] Essentially it provides the hardness and strength associated with the ivory tusk.

The basic structure and components of the ivory tusk are well established. In 1999, E.J. Raubenheimer detected 16 elements in the inorganic fraction of ivory.2 Table 1 below contains the inorganic elements in ivory, taking 64 fragments of ivory from six different geographical locations in Africa and identified by atomic absorption spectrophotometry. Research also shows that the ivory tusks of elephants living in different habitats have different properties and inorganic elements.

Table 1: Composition of Inorganic Elements in African Elephant Ivory

Major Elements (4)	Common Elements (6)	Trace Elements (6)
Calcium	Zinc	Cobalt
Phosphate	Arsenic	Cadmium
Magnesium	Lead	Manganese
Fluoride	Aluminum	Mercury
	Chromium	Molybdenum
	Copper	Nickel

In addition to inorganic elements, elephant ivory contains organic matter in the form of various proteins, amino acids and collagen. While the inorganic/organic chemical composition of ivory varies (there is soft ivory and hard ivory), the estimates range from 60/40 to 70/30.[5] This means that by weight, organic molecules, which are combustible, represent at most 30-40 percent of the ivory mass[6]; the remaining being incombustible inorganic compounds as those listed in Table 1. In short, ivory has a low British thermal unit (BTU) value and does not burn readily (i.e. self-combust). As comparison, the human body contains about 11% minerals by weight and when dried out, is very combustible.

As regards the physical parametres of elephant ivory, the material has a Mohs scale of hardness rating of 2-3 putting it with materials such as gypsum and human nails. Of course, the simplest comparison is to human teeth.

The specific gravity (density) of elephant ivory ranges between 1.8 - 1.9 grams/millilitre and as such, sinks in water. As a reference marble and granite have specific gravities of approximately 2.7.

These chemical and physical properties are provided as background as they may affect any destruction method utilized.

3. Assessment of Destruction Technologies

Various countries have engaged in ivory destruction events as a way to discourage elephant poaching and illegal trade in ivory, and to draw public attention to the scale, nature and impacts of the serious crimes that lie behind these ivory confiscations. The majority of these events displayed the burning of very large piles of elephant ivory. This section will present the advantages and disadvantages of various ivory destruction options with specific attention to adverse environmental impacts (i.e. air pollution, water contamination and land contamination), both in terms of human health as well as ecological impacts.

a. Burning of ivory

Description of Process: In 1989, Kenya took the first step in animal ivory destruction and burned a 12 metric ton pile of elephant tusks[7]. Since then, ivory burning has become a frequent method for countries and territories wishing to destroy confiscated ivory stockpiles:

– 1992, Zambia burned 9.5 tons of ivory stockpile
– 2011, Kenya burned another 5 tons (12 tons in 1989)
– 2012, Gabon burned 4.8 tons[8]
– 2014, Chad burned 1.1 tons ivory stockpile[9]
– 2014, Hong Kong began monthly burns destroying 29.6 tons of stockpile[10]
– 2015, Kenya burned approximately 15 tons big stockpile of ivory [11]
– 2015, Ethiopia also burned 6.1 tons of ivory stockpile[12]
– 2016, Kenya burned 105 tons of ivory stockpile [18]

Burning of the ivory stockpile is a bold, eye-catching political display that is meant to send a message against elephant poaching and illegal trade in ivory. It can be a powerful publicity tool if the media coverage of destruction events is effective enough13. However, the mechanism of burning ivory is much more complicated than anticipated.

As mentioned in section 2 of this document, ivory is a rather durable substance; a good analogy being human teeth14. Given that it is made up of at least 65% non-combustible material (i.e. minerals), it needs an accelerant. Experiments conducted in 2008 conducted under controlled conditions confirmed the difficulty of burning ivory15. Oxygen-enriched propane generating 982o C (1,800o F) was used to burn an ivory tusk. The results revealed a thermal decomposition decay of only 7 grams per minute (0.25 once/minute)16. On this basis, depending on the duration and temperature of the fire, it could take months to burn 1 ton of ivory stockpile17. Burning large stockpiles of ivory cannot take place without the addition of many litres of diesel fuel or other accelerant.

Given the poor combustibility of elephant ivory, open air burning does not yield the high destructive effect warranted by the negative environmental impacts. For example, in the 2016 Kenya burn, if we assume the ivory consisted of 30% organic matter and 105 tons were “burned”, then this would leave approximately 73.5 tons (0.7 x 105 tons) of uncombusted material remaining. This material would be distributed within the resultant ash pile and the released airborne particulates. This technology will render the elephant ivory unusable only if it is subjected to sufficiently high temperatures and periods of burning.

Advantages:

– Burning is a strong visual discouragement.
– It is low technology that is relatively easy to administer.
– It can be done locally with no special land requirements.
– When done properly, it can render ivory unusable.

Disadvantages:

– Large amounts of accelerant fuel are needed (petrol, diesel) to initiate and sustain combustion.
– Substantial amounts of un-combusted ivory remain.
– Substantial amounts of ash need further disposal.
– Flammability hazard needs managing.
– Many safety concerns: accidents, collapsing pile, burns, all presents worker risks.

Environmental Impacts:

– Potential toxic exposure to accelerant fuel(s).
– Burning produces tremendous quantities of air pollution emitted, including
    o Total suspended particulates
    o Fine particulates (PM2.5)
    o Oxides of nitrogen
    o Carbon monoxide
    o Sulfur dioxide (from accelerant fuel source)
– The air pollutants generated can be transported long distances and impact other communities and crops.
– The air pollutants generated can significantly affect human health and welfare.

Summary:

– Burning of ivory is a viable destruction method if administered correctly but has considerable undesirable environmental side-effects.

b. Crushing of ivory - Mechanical method

Description of Process: Crushing is another commonly used ivory destruction method and can be further divided into mechanical or manual processes.

In 2012, Gabon crushed a larger stockpile of ivory, about 4.8 tons [18] followed by an event in 2013 in the Philippines. The Philippines event was the first non-African country to introduce crushing as an ivory destruction method. They used a road roller and the bucket of a mechanical digger for this purpose [19] In the same year, the U.S destroyed 6 tons of ivory in Denver, Colorado and one year later, more than 6 tons of ivory was destroyed in Beijing, China [20]. France was the first European nation that publicly crushed more than 3 tons of ivory in 2014[21]. As ivory destructions events continue, a pattern seems to reveal itself. It seems that African countries are more inclined to burn their ivory stockpiles, while other parts of the world tend to crush it. Is the crushing more effective than burning? It turns out the crushing is not without its challenges, especially when the stockpile is very large, as is the case in African countries. In 2013, the U.S. used massive rock crushers to pulverize the ivory piles [22] Given that elephant ivory is much softer and more brittle than granite and other rocks, these mechanical crushing units can operate faster and more efficiently.

The ultimate goal of crushing, whether, manual or mechanical, is to produce ivory particles of no economic value. However, once crushed, the material must still be carted away and disposed of properly. Fortunately, crushed elephant ivory is not considered hazardous waste by some environmental agencies (US EPA and EU) so on-site burial is possible. However, care must be taken to ensure that any residual matter does not enter illegal trade and pulverization and/or incineration at high temperature may be needed to ensure that this is the case. One notable feature is that, as the material has not undergone any chemical alteration, given the very high concentration and purity of important inorganic elements such as calcium, phosphate, and magnesium, these minerals can be identified, recycled and reused. At the point at which crushing has rendered the ivory unusable for other commercial purposes, this product could be a commodity that could help offset operation costs and eliminate any remaining waste disposal costs.

Advantages:

– Almost complete destruction
– Mobile crushing equipment is readily available and can travel to sites.
– Large scale crushing equipment is commonplace in stone quarries where base material for cement manufacturing is used.
– Large mechanical rock crushing units have proven fast and efficient because elephant ivory is much softer and more brittle than granite and other rocks.
– Essentially, climate friendly and with almost zero environmental emissions (except the fuel for the mechanized crusher).
– Crushed elephant ivory is not considered hazardous waste by some environmental agencies and on-site burial is possible.

Disadvantages:

– Material needs subsequent disposing and could be of commercial value.
– Care needed to ensure that residual matter does not re-enter illegal trade.
– Specialized skills needed to operate equipment.
– Some crushing tools (e.g. road rollers) are relatively inefficient and further action may be needed to fully destroy the ivory.
– Safety concerns: slips, trips, falls, and flying debris present worker risks.
– Noise: rock crushers are very loud and hearing protection is usually necessary.

Environmental Impacts:

– Inorganic dust emissions from crushing operation, with little or no environmental impact (except the fuel for the mechanized crusher).

Summary:

– A viable and environmentally sound method for elephant ivory destruction, with low risks.

c. Crushing of ivory - Manual

Description of Process: Manual crushing refers to humans physically striking and breaking ivory tusks into small and unusable objects with a hammer or other equivalent device. Ivory, as stated earlier, is brittle and easily broken by these tools as is human bone. For small scale operations, this may be a reasonable option. During the 2013 Philippines crushing event, it took many hacksaws, a small roller, and a backhoe to break up the ivory stock. And ultimately the remaining debris still had to be incinerated[23]. It is a quite labour intensive method and may present risks of pilfering the ivory. This technology will in most cases render the ivory unusable, but additional steps such as pulverization and/or incineration at high temperature may be needed as noted above.

Advantages:

– Low dust generation.
– In most cases, complete destruction.
– Requires little technology and skill.
– Relatively inexpensive.
– Labour pool is readily available.

Disadvantages:

– Material needs subsequent disposing and could be of commercial value.
– Time-consuming and not amenable for large quantities.
– Theft / pilfering risk is high.

Environmental and Human Health Impacts:

– Noise: rock crushing is loud and may exceed regulatory levels. Hearing protection is usually necessary.
– Safety concerns: flying debris presents worker risks, accidents.

Summary:

– A viable and environmentally sound method of disposing of elephant ivory, only where small quantities are involved.

d. Chemical Treatment

Description of Process: Chemical treatment has been widely used for the destruction of persistent organic pollutants, pesticides, polychlorinated biphenyls (PCB) and even chemical warfare agents. With regard to ivory, strong acids, alkalies and oxidant chemicals have the ability to dissolve the organic components of bone (i.e. proteins) and theoretically can be used as a destruction option. The inorganic matrix of ivory is more difficult to “dissolve”, but possible. The destruction is accelerated when supplemented with high heat and pressure. Breaking the ivory into smaller pieces increases surface area and will also increase dissolution rates. A literature search revealed no published papers on this approach; however, it is a common hazardous waste disposal technology. The challenges for large scale application of chemical destruction of ivory include, specialized vessels and equipment, cost of the reagents and trained personnel. This technology will render the elephant ivory unusable.

Advantages:

– Almost total destruction of ivory can be achieved.
– Technology readily available.
– No air emissions.
– Manageable industrial process.

Disadvantages:

– Expensive.
– Specialized equipment, vessels and trained staff needed.
– Reagents much be purchased and stored properly.
– Reagents are toxic and must be handled with care.
– Residual waste will be classified as hazardous and must be neutralized.
– Unlikely all ivory will be dissolved / destroyed.
– Relatively slow and time intensive.
– Ivory and reagents may have to be transported to the processing site.

Environmental and Human Health Impacts:

– Enhanced worker protection needed due to corrosive and toxic agents.
– High likelihood of spillage and land contamination.
– Final wastes need neutralizing and cannot be readily disposed of.
– It is fundamentally a high-risk technology.

Summary:

– A non-viable and environmentally unsound method for ivory destruction, with relatively high risks.

e. Land Burial

Description of Process: The natural environmental sink for ivory is, of course, land destruction or burial. With the exception of damage done by a few insects, ivory is relatively immune to natural decay and extremely durable. The fossilized remains of prehistoric animals continue to be discovered millenniums later. Therefore, the simple burial of ivory will not render it unusable. However, deep land burial may be an inexpensive and applicable option given the correct terrain. The concept here is to render the material inaccessible by either disposing in pre-dug deep wells or excavation sites. However, future inaccessibility is questionable and will always present a risk given raw ivory is quite valuable at hundreds of euros per kilogram.[24]

Advantages:

– Low technology solution.
– Excavation equipment often readily available.
– Adaptable to many terrains and climate zones.

Disadvantages:

– Strong motivation to recover disposed ivory.
– Depending on site, future accessibility of material may require monitoring efforts.
– Does not decay quickly.

Environmental and Human Health Impacts:

– Very low environmental impact (no chemicals uses, no air emissions).
– Some occupational health and safety risks during “construction” possible.

Summary:

– Environmentally sound method of disposing of ivory, but with risks that material could be retrieved considered non-viable.

f. Destruction by Disposal at Sea - Shallow / Continental Shelf

Description of Process: For purposes of this assessment, disposal at sea has been divided into shallow and deep-sea disposal. Shallow disposal at sea is the direct release of intact ivory materials onto the continental shelf; including onto deep coral reefs. Given the possible accessibility and recovery of ivory at very shallow disposal, the goal is to dispose of the material at depths greater than 40 metres. Recreational divers usually do not venture more than 39 metres (130 feet). Most coral reefs are shallow

and lie within the euphotic zone of the continental shelf where sunlight can sustain marine life. Disposal onto reefs less than 18 metres deep may render the ivory accessible through either persons using SCUBA or advanced snorkeling practices.

Ivory can be a very valuable resource for coral reefs building and ecological marine recovery and/or sustainability. Numerous commodities have been disposed of off-shore to help build and recover reefs including obsolete New York City subway cars, out-of service shipping containers and even marine vessels.[25] Given the chemical composition of ivory, such material will unlikely have a negative ecological impact and most probably enhance marine ecosystems. Additionally, given most seaside communities have existing shipping capabilities, this option does not require a large-scale infrastructure investment. Evidence suggests that immersion of ivory in sea water does not result in its complete destruction and as this method may not render the ivory inaccessible the site for any disposal should be carefully selected and disposal in deep sea may be preferred.

Advantages:

– Relatively low technology.
– Recovery of material may require considerable logistical effort.
– Helps to build/rebuild marine ecosystems.
– No pre-treatment of ivory necessary (whole ivory disposal).
– Numerous sites available.

Disadvantages:

– Fuel and labour cost to bring material to disposal site may be costly.
– For landlocked countries, ivory transport to a coast may be costly.
– Security risks whilst material is being transported for disposal.
– Theft / pilfering risk.
– Possibility of ivory being recovered.

Environmental and Human Health Impacts:

– Very low environmental health impacts.
– Very low adverse ecological impacts.

Summary:

– Environmentally sound method of disposing of ivory, but with risks that material could be retrieved and therefore considered non-viable.

g. Destruction by Disposal at Sea - Deep Sea or Continental Slope/Rise

Description of Process: Deep ocean disposal refers to the direct dumping of ivory onto either the continental slope or rise, or directly onto the oceans abyssal plain. Essentially disposing of ivory at depths greater that 60 metres. The average depth of the Earth's oceans is approximately 3,500 metres making recovery essentially impossible. Given the possible elevated costs of reaching these sites, several possible scenarios include using existing shipping traffic to expedite disposal and/or partnering with the personal Cruise Line industry to help facilitate disposal. The actual disposal may consist of either off loading individual ivory pieces into the ocean or unloading an entire 12 metre shipping container full of ivory into the ocean. Numerous possibilities exist. The added awareness of permanent disposal, using the Cruise Line Industry, would bring improved and heightened awareness to the illegal ivory collection and trade. Lastly, given the open ocean is often only less than 50 kilometres offshore, even contracted shipping makes this a viable option. This technology will render the ivory inaccessible.

Advantages:

– Relatively low technology.
– Recovery of material likely to require considerable logistical effort.
– No pre-treatment of ivory necessary (whole ivory disposal).
– Unlimited sites.
– Possible marine benefit.

Disadvantages:

– Fuel and labour cost to bring material to disposal site may be costly.
– For landlocked countries, ivory transport may become costly.
– No immediate benefit to building or rebuilding marine ecosystems.
– Theft / pilfering risk.
– Possibility that ivory could be recovered, although low and improbable.
– Some security risks whilst material is being transported for disposal.

Environmental and Human Health Impacts:

– Very low environmental health impacts foreseen.
– Very low adverse ecological impacts foreseen

Summary:

– Environmentally sound method of disposing of ivory, but with slight risk that material could be retrieved and therefore considered undesirable.

4. Conclusions

The assessment of ivory destruction approaches presented above yields only a few viable options. Most notably; *Mechanical Crushing* seem most promising when looking at effectiveness and environmental impacts. Mobile rock crushing equipment is commonplace given their use within the building and road construction industry. Adapting these units to destroy elephant ivory is relatively simple with no special modifications. Disposal of crushed material, provided it is sufficiently pulverized, should be relatively simple. The minerals in this pulverized material could even be recycled and sold or donated as a commodity to help offset operation costs. In earlier tests using stone crushers, the waste material was mixed with cement to ultimately produce concrete. Manual Crushing (i.e. by hand) is unlikely to be a feasible option given the high volume of ivory and large labour requirements. Theft of ivory pieces may be a problem with the manual crushing operation.

For countries that border on large water bodies, destruction by *Disposal at Deep Sea* may prove the simplest and most direct way of disposing large quantities of animal ivory. The likely existence of commercial seaports within these countries offers an existing system to implement such a practice. There is a very low environmental impact of the destruction by *Disposal at Deep Sea* option. However, the likely associated security costs, risk of corruption and theft and possible retrieval of such ivory, make this an option that does not seem desirable.

It is important to keep in mind that, if selected as a disposal option, ivory destruction is episodic and unlikely to be an ongoing daily or monthly event. Therefore, the selection of an environmentally friendly method should be evaluated within that context. The options for the environmentally sound destruction of elephant ivory presented above must, of course, also be considered in economic terms.

Mechanical Crushing seems most likely to meet the requirements of permanent and safe destruction method for ivory, with minimum environmental health or ecological risk.

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