2022

Certificate Authority Cup International Mathematical Contest Modeling

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Problem D (ICM)
Whether Wildlife Trade Should Be Banned for a Long Time

Wild-animal markets are the suspected origin of the current outbreak and the 2002 SARS outbreak, And eating wild meat is thought to have been a source of the Ebola virus in Africa. Chinas top law-making body has permanently tightened rules on trading wildlife in the wake of the coronavirus outbreak, which is thought to have originated in a wild-animal market in Wuhan. Some scientists speculate that the emergency measure will be lifted once the outbreak ends.

How the trade in wildlife products should be regulated in the long term? Some researchers want a total ban on wildlife trade, without exceptions, whereas others say sustainable trade of some animals is possible and beneficial for people who rely on it for their livelihoods. Banning wild meat consumption could cost the Chinese economy 50 billion yuan (US $ 7.1 billion) and put one million people out of a job, according to estimates from the non-profit Society of Entrepreneurs and Ecology in Beijing.

A team led by Shi Zheng-Li and Cui Jie of the Wuhan Institute of Virology in China, chasing the origin of the deadly SARS virus, have finally found their smoking gun in 2017. In a remote cave in Yunnan province, virologists have identified a single population of horseshoe bats that harbours virus strains with all the genetic building blocks of the one that jumped to humans in 2002, killing almost 800 people around the world. The killer strain could easily have arisen from such a bat population, the researchers report in PLoS Pathogens on 30 November, 2017. Another outstanding question is how a virus from bats in Yunnan could travel to animals and humans around 1,000 kilometres away in Guangdong, without causing any suspected cases in Yunnan itself. Wildlife trade is the answer. Although wild animals are cooked at high temperature when eating, some viruses are difficult to survive, humans may come into contact with animal secretions in the wildlife market. They warn that the ingredients are in place for a similar disease to emerge again.

Wildlife trade has many negative effects, with the most important ones being:

Figure 1: Masked palm civets sold in markets in China were linked to the SARS outbreak in 2002.Credit: Matthew Maran/NPL

- Decline and extinction of populations
- Introduction of invasive species
- Spread of new diseases to humans

We use the CITES trade database as source for my data. This database contains more than 20 million records of trade and is openly accessible. The appendix is the data on mammal trade from 1990 to 2021, and the complete database can also be obtained through the following link:
`https://caiyun.139.com/m/i?0F5CKACoDDpEJ`

Requirements Your team are asked to build reasonable mathematical models, analyze the data, and solve the following problems:

1. Which wildlife groups and species are traded the most (in terms of live animals taken from the wild)?
2. What are the main purposes for trade of these animals?
3. How has the trade changed over the past two decades (2003-2022)?
4. Whether the wildlife trade is related to the epidemic situation of major infectious diseases?

5. Do you agree with banning on wildlife trade for a long time? Whether it will have a great impact on the economy and society, and why?

6. Write a letter to the relevant departments of the US government to explain your views and policy suggestions.