

## 2021 Asia and Pacific Mathematical Contest in Modeling

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### Problem C

#### **Construction of Ecological Conservation and Assessment of Its Impact on Environment**

Adhere to the concept that lucid waters and lush mountains are invaluable assets, China insists on respecting for, being harmony with and protecting nature, giving high priority to conserving resources, protecting the environment and letting nature restore itself, implementing sustainable development strategies, improving the overall coordination mechanism in the field of ecological civilization, building an ecological civilization system, promoting the transformation of economic and social development toward comprehensive green growth and building a beautiful country. With the help of the Chinese government, China's Saihanba Tree Farm has recovered from the desert and has now become an eco-friendly and green farm with the stable sand prevention function.

Since 1962, 369 young people with an average age under 24 have come to this wasteland filled with yellow sand. From then on, they dedicated their lives here, advanced wave upon wave, to planting seeds in the sand and planting green in the crevices of the stones, like nails fastening millions of acres of forest on the wasteland. Planting trees to fix the sand and conserve water sources, they build a green barrier to block wind and sand. Today, the forest coverage in Saihanba area has reached 80%. It supplies Beijing and Tianjin with 137 million cubic meters of clean water each year, sequesters 747,000 tons of carbon, and releases 545,000 tons of oxygen.

With over a half century's struggle, the world's largest artificial forest was built on the earth of Saihanba. Expanding afforestation of 1.12 million mu with more than 400 million trees, the builders created a green sea on the plateau wasteland which is 400 kilometers north of Beijing.

On the one hand, there is the historical mission that "civilization will develop followed with zoology thriving". On the other hand, there are new issues encountered on the road of green development. Therefore, Saihanba people now have a higher goal, which is to restore the ecology. Since the 18th National Congress of the Communist Party of China, they have successively launched three major projects, namely, afforestation, natural improvement of artificial forests, and near-naturalization cultivation of natural forests. They have tried to make artificial forests closer to natural ones.

Please build the mathematical models by your team and answer the following questions:

1. Saihanba plays an important role in resisting wind and sand, protecting environment, maintaining ecological balance and stability, etc. Please select appropriate indicators, collect relevant data, and build the evaluation model for the impact of Saihanba on the ecological environment, in order to quantitatively evaluate the impact on the environment after the restoration of Saihanba; that is, to comparatively analyze the environmental conditions before and after the Saihanba restoration.

2. The restoration of Saihanba Tree Farm has played an important role in resisting sandstorms for Beijing. Please select appropriate indicators and collect relevant data to build a mathematical model for evaluating the Saihanba's impact on Beijing's ability on sandstorm resistance, and quantitatively evaluate Saihanba's role in resisting sandstorms in Beijing.

3. Suppose we plan to extend the ecological protection model of Saihanba to the whole country, please build a mathematical model and collect relevant data, to determine which geographical locations in China need to build ecological areas (ie. Ecological Reservation), and fix the number or scale of ecological areas to be built; moreover, to evaluate its impact on achieving China's carbon neutral target.

4. China's Saihanba ecological protection model has made an example for the Asia-Pacific region. Please choose another country from the Asia-Pacific region to establish a mathematical model and collect relevant data, and then discuss which geographical locations in this country need to build an ecological area (ie. Ecological Reservation), as well as determine the number or scale of ecological areas to be built; moreover, to evaluate its impact on absorbing greenhouse gases and mitigating carbon emissions.

5. Please write a non-technical report to the Asia-Pacific Mathematical Contest in Modeling Organizing Committee (APMCM), describing your models, and proposing feasible plans and suggestions for building ecological reservation.

**Tips:** In the process of building the models, you can consider condition of the existing ecological forests in China and other Asia-Pacific regions; the requirement of growth environment for different trees (that is, the specific area for certain tree); how to balance the layout of ecological forest land, economic development land and industrial land; and whether the aimed geographical area has enough land available to develop the ecological reservation.

**Reference:** [http://lycy.hebei.gov.cn/shb/show\\_article.php?id=5876](http://lycy.hebei.gov.cn/shb/show_article.php?id=5876)