

### **Problem A: 中国阿尔泰山 630 公里河岸景观沿线鸟类丰富度与植被覆盖关系数学建模**

**Problem description:** In order to understand bird richness and variation in species composition along a 630 km riparian landscape in the Altai Mountains of China. Scientists selected nine regions along a gradient of natural vegetation change. Bird surveys and environmental measurements were conducted at 10 points in each of the nine regions. And they collected environmental land cover variables such as wood cover (area proportion of trees and shrubs with saplings in habitats; here trees are woody plant with a single trunk and higher than 3 m. (See two attached excel files)

This Problem is based on the following article. (See details in the attached pdf files) Li N, Sun Y, Chu H, et al. Bird species diversity in Altai riparian landscapes: Wood cover plays a key role for avian abundance. Ecol. Evol. 2019; 9: 9634–9643. <https://doi.org/10.1002/ece3.5493>

#### **Questions include the following:**

- According to the data in the attachment excel files, give description and analysis of the spatial and altitude distribution of birds and wood in Altay region.
- What is the impact on the bird population in the Altai Mountains ecological system? Under reasonable simplified assumptions, construct a continuous model to describe the relationship between birds and other ecological groups such as plants, human et al in Altay region.
- What is the impact on the stability of the ecosystem given the changes of plants? Using you established models to predict the population changes of birds under the influence of external factors.

#### **Your PDF solution of no more than 25 total pages should include:**

- One-page Summary Sheet.
- Table of Contents.
- Your complete solution.
- References list.
- AI Use Report (If used does not count in the 25-page limit.)

#### **Note:**

You may use up to 25 total pages for all your solution work and any additional information you want to include (for example: drawings, diagrams, calculations, tables).

We permit the careful use of AI such as ChatGPT, although it is not necessary to create a solution to this problem.

If you choose to utilize a generative AI, this will result in an additional AI use report that you must add to the end of your PDF solution file. And it does not count in the 25 total page limit for your solution.