**Rain Forests and Palm Oil**

**See How the Oil Palms Grow**

Borneo, in Indonesia, is the largest producer of palm oil which is used in foods, cosmetics, detergents, and biofuel. To keep up with demand for the oil Borneo has been logging rain forests and burning the logged areas to allow for the creation of oil palm plantations.[[1]](#footnote-1) This results in the loss of rain forests while producing large amounts of CO2. Indonesia is now the third largest producer of CO2 emissions due largely to the increase in palm oil production. To determine what will happen in the future if the current trend continues, we must first create a mathematical model of the increase in palm oil production. The table below gives the production of palm oil in Indonesia (most in Borneo) in five year increments since 1965. Each production number is in thousands of metric tons. To make it easier to plot the data and find a mathematical model we will translate all of the *x-*values so the first point is (0, 174). Show the translation used and the translations of each year in the second column in the table below.

Palm Oil Production 1965 - 2005

|  |  |  |  |
| --- | --- | --- | --- |
| **Year** |  | **Indonesian Production**  | **Average****Value of *b*** |
| 1965 |  | 174 |  |
| 1970 |  | 248 |  |
| 1975 |  | 434 |  |
| 1980 |  | 752 |  |
| 1985 |  | 1280 |  |
| 1990 |  | 2650 |  |
| 1995 |  | 4850 |  |
| 2000 |  | 8300 |  |
| 2005 |  | 15000 |  |

Since the growth in production was slow at the beginning and fast at the end of the period of time under consideration, we suspect that an exponential function model  will work. To see if this suspicion is correct, we start with the assumption that the rate of change is the same for each year in each 5-year period. For example, if the yearly rate of change is *b* for the first 5-year period, then the production in 1966 will be , the production in 1967 will be , etc. until 1970 when the production will be . Solve this equation for *b* to obtain the average value of *b* for this 5-year period and enter its value in the table in the 1970 row. Note: To obtain the 5th root of 248/174: 5 {the index}  5 {}  248  174  

1. Do this for each 5-year period. (Hint: The equation to find *b* for the second 5-year period is , so .)
2. Look at the values of *b* you calculated and recorded in the table on page 28. Are these ratios relatively close to each other? If they are, an exponential function model will work. Will an exponential model be a good choice to model the growth in palm oil production?

To find our model we need values for the two parameters *a* and *b* for an exponential function model .

1. Look again at the table on the first page. What is a good choice for the value of *b*? Justify your choice.

 *b* =

Reason for choice:

1. Next, we need to know the value of *a*, the initial value of the function. What is the initial production value (the value corresponding to a translated *x*-value of 0)?

 *a* =

1. Use your values for *a* and *b* to write an exponential function model for the data. Note that the exponent will not be *x*, but the translation you used to get the second column.

Function Model:

1. Use your model to predict the palm oil production this year if this trend continues. Show how you found your prediction.
2. Use your model to predict the palm oil production in 2025. Show your work.
3. What does it mean for the environment and global warming if the demand (and production) for palm oil continues to grow at the same rate? Explain your thinking.
4. Indonesia is a very poor country and its inhabitants need the money they make from palm oil. Should we try to reduce the demand for palm oil? Justify your answer using your model in your response.
5. What can *you* do to reduce the demand for palm oil?

*End of Project*

1. Information and data comes from November, 2008 National Geographic. Vol. 214. No. 5 and <http://www.indexmundi.com/en/commodities/agricultural/oil-palm/>. [↑](#footnote-ref-1)