**Name:**

**Date:**

**School:**

**Facilitator:**

2.05 Carrying Capacity Lab

# Instructions:

**Use Tables 1 and 2 to determine the carrying capacity for an ecosystem of an oak tree and analysis questions.**

**Table 1: Oak Species in Virginia**

|  |  |  |
| --- | --- | --- |
| **Common Name** | **Scientific Name** | **Habitat** |
| White Oak | Quercus alba | dry or moist woods |
| Post Oak | Quercus stellata | dry soil |
| Blackjack | Quercus marilandica | dry, barren soils |
| Spanish Oak | Quercus falcata | woods |
| Water Oak | Quercus nigra | coastal plain |

**Table 2: Acorn Yield (kilograms) per Year per Hectare**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Diameter of tree (cm) | Oak Species | | | | |
|  | White Oak | Post Oak | Blackjack | Spanish Oak | Water Oak |
| 10 | ----- | 0.3 | ----- | ----- | ----- |
| 15 | ----- | 0.6 | ----- | ----- | ----- |
| 20 | 0.2 | 1.0 | ----- | 0.5 | 0.7 |
| 25 | 1.2 | 1.3 | 0.8 | 1.4 | 1.8 |
| 30 | 2.2 | 1.6 | 1.5 | 2.3 | 3.1 |
| 35 | 3.2 | 1.9 | 2.2 | 3.2 | 4.2 |
| 40 | 4.2 | 2.3 | 3.0 | 4.1 | 5.4 |
| 45 | 5.2 | 2.6 | 3.7 | 5.0 | 6.6 |
| 50 | 6.2 | 3.0 | 4.6 | 5.9 | 7.8 |
| 55 | 7.2 | 3.3 | 5.2 | 6.7 | 9.0 |
| 60 | 8.2 | 3.6 | 5.9 | 7.6 | 10.1 |
| 65 | 9.2 | 4.0 | 6.7 | 8.5 | 11.3 |

NOTE: Scientists use the metric system for all measurements and data. The units in this lab are metric and you will not need to convert any units from one to the other. However, here are some conversions that might help you put in perspective the metric units you see here:

1 inch = 2.54 cm

1 kg (kilogram) = 2.2 lbs (pounds)

1 hectare = 2 ½ acres

1. Looking at **Tables 1 & 2**, what type of forest will yield a maximum supply of acorns?

name of tree

diameter of tree in cm

habitat

1. A hectare is equal to nearly 2 ½ acres (an area of about two football fields). Assume there is a population density of 25 oak trees per hectare. Using the species (name of the tree) and diameter of tree you selected for #1, calculate the acorn potential for each hectare of the forest for one year.

      kg of acorns per year (this is found in Table 2 also)

X       oaks per hectare

=       kg of acorns produced each year per hectare.

1. Assuming that the average deer requires 3 kilograms of food a day and that 75% of the diet is acorns:
   1. Calculate how many deer each hectare of this forest could support for a year:
      1. kg of food per day

X       (change 75 % to a decimal)

=      kg of acorn needed per day.

* + 1. kg of acorn needed per day

X       number of days per year

=       kg of acorns needed per year.

* + 1. (answer from # 2) kg of acorns produced each year per hectare

÷      (answer from # 3aii)kg of acorns needed per year by each deer =      deer per hectare.

* 1. Calculate how many deer the entire forest could support for one year. The forest covers 7906 hectares:

deer per hectare (use answer you found in # 3aiii)

X       the number of hectares

=     deer in the entire forest.

1. Scientists estimate that about 15% of the acorns produced is eaten by birds and others that feed in the trees so only 85% reaches the ground. Adjust your calculations to take this factor into account:
   1. Calculate how many deer each hectare of this forest could support for a year. **This is the** **true carrying capacity!**

     deer per hectare (see # 3aiii)

X       (change 85 % to a decimal) that reaches ground

=     deer per hectare.

* 1. Calculate how many deer the *entire forest* could support for one year:

     deer per hectare (see 4a)

X     number of hectares the forest covers

=     deer in entire forest (true carrying capacity)

1. A businessman who owns the forest (7906 hectares) decides that he needs some money to help pay some unexpected bills. He selectively cuts 8 trees per hectare.
   1. Now how many trees are there per hectare?

Use this number to determine the **new true carrying capacity** for the forest. We could use this number and go all the way through steps 2 – 4 again. However, let’s use this number and determine the answer by using a fraction or decimal.

* 1. % of new number of trees compared to original (answer to # 5a/25 – convert to decimal form)

X     deer in entire forest (see 4b)

=      new true carrying capacity

1. A nearby forest experiences a forest fire that destroys the entire habitat. Many of the birds and squirrels escape and immigrate to this forest that has just been selectively cut. This reduces the amount of acorns that reach the ground from 85 % to 70 %. What is the new **true carrying capacity** for the forest? Repeat the procedure for # 4.
   1. Calculate how many deer each hectare of this forest could support for a year.

     deer per hectare (see # 3aiii)

X       (change 70 % to a decimal) that reaches ground

=     deer per hectare.

* 1. Calculate how many deer the *entire forest* could support for one year:

     deer per hectare (see 6a)

X     number of hectares the forest covers

=     deer in entire forest (new true carrying capacity based on 70% hitting the ground)