See the abstract describing research by Strand et al. on the tree-hole mosquito, *Aedes triseriatus*. The authors want our help in evaluating the potential consequences of changes in litter quality for mosquito populations. Attach your work.

1. Estimate the rate of population increase for mosquitoes that encounter tree-holes filled with oak leaves grown in the sun vs. birch leaves grown in the sun vs. birch leaves grown in the shade. Show units.

   Population growth rate on oak sun leaves = ___________________

   Population growth rate on birch sun leaves = ___________________

   Population growth rate on birch shade leaves = ___________________

2. Given your estimated rates of population growth, calculate the size of two mosquito populations that each begin with 1000 overwintering eggs (1:1 sex ratio) and grow throughout the summer (120 days), but encounter either birch sun leaves or birch shade leaves.

   Final population size (of overwintering eggs) with birch sun leaves = ___________________

   Final population size (of overwintering eggs) with birch shade leaves = ___________________

3. Refer to question 1 above. Were the differences between estimated population growth rates for sun and shade leaves most due to differences in mosquito survival, development time, or adult mass? (circle one)

   survival  development time  adult mass

   Justify your answer
Effects of atmospheric CO₂, light availability, and tree species on the quality of leaf detritus as a resource for treehole mosquitoes.  R.M Strand et al.

Environmental conditions that affect leaf quality can influence detritivory in heterotrophic aquatic ecosystems. Some aquatic detritivores are sensitive to change in leaf structural and nutritive properties as induced by herbivory and alteration of soil fertility. Sunlight availability strongly influences carbon-based secondary metabolite concentration in leaves in a manner predicted to affect decomposition. Deciduous trees can also increase leaf allelochemical concentrations in response to elevation of atmospheric CO₂ which tends to decrease decomposition rates by terrestrial detritivores. The effects of insolation and atmospheric CO₂ have not been evaluated in aquatic systems.

Leaf detritus is the trophic foundation for the spatially discrete aquatic ecosystems that develop in water-filled treeholes. Larvae of the Eastern Treehole Mosquito, *Aedes triseriatus* Say, are often the dominant detritivores in treeholes of eastern North America. Like other aquatic insect detritivores, the growth and development of *A. triseriatus* larvae can be strongly affected by litter quality. Their large geographic range, easily replicated microhabitat conditions, and high sensitivity to litter quality make *A. triseriatus* an appropriate model organism for identifying the potential effects of environmental change in heterotrophic aquatic ecosystems.

We tested effects of atmospheric CO₂ concentration, light availability to trees, and tree species, on the quality of leaf detritus as a resource for *Aedes triseriatus*. Larvae were reared in laboratory microcosms (simulated treeholes) with naturally senesced, abscised foliage from seedlings of red oak, *Quercus rubra*, and paper birch, *Betula papyrifera*, grown under ambient concentrations of atmospheric CO₂ and doubled CO₂. Elevated CO₂ did not have effects on any measure of mosquito performance. In contrast, host species and light availability had significant effects on mosquito survival, development time, and adult mass.

### Table 1. Data summary from Strand et al. Values are treatment means.

<table>
<thead>
<tr>
<th>Survival (%) [egg hatch to adult emergence]</th>
<th>Development time (d)</th>
<th>Adult mass (mg)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>males</td>
<td>females</td>
</tr>
<tr>
<td>Oak-Sun</td>
<td>40</td>
<td>17.4</td>
</tr>
<tr>
<td>Birch-Sun</td>
<td>25</td>
<td>37.6</td>
</tr>
<tr>
<td>Birch-Shade</td>
<td>39</td>
<td>22.0</td>
</tr>
</tbody>
</table>

**Other potentially useful information:** *Aedes triseriatus* can have multiple generations per year (multivoltine) but only eggs can successfully overwinter. *A. triseriatus* adults are short-lived and semelparous (i.e., females only produce one clutch of eggs.) Fecundity of female adults is linearly related to their mass (mg) as: \( \text{EGGS} = 14.3 + 91.7 \times \text{Mass} \). It has been estimated that the mean time from adult emergence to egg hatch is 7 days.