Vermont’s Indiana Bat Population

Prior to 2001, all information regarding Indiana bats in the state originated from hibernacula counts. Historically, Indiana bats were documented in 5 caves/mines, but total counts never exceeded a few hundred bats. Today, Indiana bats are documented in 3 hibernacula (see Fig. 1) and total an estimated 500 bats.

In 2001, spring emergent tracking work done with the USFWS and New York DEC demonstrated that a large portion of the Barton Hill Mine Indiana bat population (2007 census of 9393 Indiana bats) migrates into the Champlain Valley of Vermont. Since then, Vermont Fish and Wildlife Department (VTFW) and the USFWS have expended considerable time and funds surveying the valley to determine the distribution and range of maternity colonies in the state. To date, a total of 167 Indiana bats have been captured and banded in the Champlain Valley, 59 of which were fitted with radio transmitters to track their range and habitat use. The summer range is currently estimated to be approximately 650 square miles.
Given the number of Indiana bats at the Barton Hill Mine and the limited area that is occupied in Vermont, the Champlain Valley contains a rather dense population of Indiana bats. To illustrate the density of bats in the valley, of the 10 new survey sites selected in 2007, Indiana bats were captured at 9 of them. Simple math calculations below demonstrate the potential densities within the region. The table is likely an underestimate, given that the square mileage of forestland includes 4 towns north of the known Indiana bat range.

<table>
<thead>
<tr>
<th>Barton Hill Mine Pop</th>
<th>% Females in VT</th>
<th>% Males in VT</th>
<th>Total Indiana bats in VT</th>
<th>Bats/Mi² Forestland</th>
</tr>
</thead>
<tbody>
<tr>
<td>9393</td>
<td>75%</td>
<td>50%</td>
<td>5872</td>
<td>24.3</td>
</tr>
</tbody>
</table>

To date, a total 10 Indiana bat maternity colonies have been documented during the reproductive period (May 15 – August 1). The distribution of the known colonies (centered at the primary roost tree with a 3-mile radius) is shown in Figure 2. The estimated sizes of the colonies (from exit counts) average 89 bats, varying greatly from 14 to over 270 bats.
Fig. 2 Locations of known Indiana bat maternity colonies
A graduate research project recently evaluated the roosting and foraging habitat of 3 maternity colonies (1 in New York and 2 in Vermont). The work culminated in a landscape analysis model that evaluated 14 variables at various scales. Area of forestland and aspect were found to be the most consistent features of roosting habitat. The model calculated that approximately only 5 – 8% of the Champlain Valley land area is suitable Indiana bat habitat. It should be noted that the Chaplain Valley in this study was defined as the entire biophysical region that extends to the Canadian border. A follow-up analysis will be conducted this winter using the 11 Vermont maternity colonies.

**Indiana Bat Habitat of the Champlain Valley**

The Champlain Valley of Vermont provides the lowest, warmest, and driest habitat conditions in the state. The valley sits between the Green Mountains of Vermont and the Adirondack Mountains of New York. No maternity colony roost trees have been documented within the valley above 575 feet in elevation, and no males have been captured above 650 feet in elevation (one male did roost at 1050 feet).

The figure below shows forest cover for the Champlain Valley biophysical region. The limited forest cover demonstrates the valley’s statewide importance to agriculture. As a result, forest cover is limited to 32.6% of the land area, and it is comprised of many (4,562), small (avg size = 33.75 acres) patches of forestland. The Champlain Valley is the only region of Vermont that has had forest cover decline by more than 5% since 1983. Forest cover data and orthophotos for each documented maternity colony site (roost trees and 3-mile radius foraging range) are provided in Appendix A.
Indiana bat habitat within the Champlain Valley is threatened by both the loss of farmland in the state as well as the increasing development pressure, much of which comes from Burlington and Middlebury. In addition, the region’s forests also serve as a fuel source to the Burlington Electric Department’s wood chip plant. Wood chips are provided by clearcutting activities that do require a permit review by the VFWD.

Indiana bat habitat loss in the region is partially deterred due to a long-term strategy to conserve farmland through conservation easements held by land trusts. To date, over 14% of the region is conserved, only 30% of which is forested land.

**Vermont State Regulations for Habitat Protection**

Vermont has some of the most progressive wildlife habitat protection measures from development in the nation. Act 250, Vermont’s land use law, requires larger commercial, residential, and transportation development projects to be reviewed for impacts to 10 criteria, including endangered species and “necessary wildlife habitat”. Residential developments that generally exceed 9 lots require such a permit. All Act 250 permit
applications are reviewed by Department personnel that, when applicable, submit comments, testify at hearings, and seek avoidance, mitigation, or permit denial.

To date, VFWD has participated in three Act 250 projects that would have affected Indiana bat habitat. Two of the projects were residential developments near Indiana bat hibernacula, and one was a residential development near a known maternity colony. In the former cases, the hibernacula and its associated roosting and foraging habitat in the vicinity were deemed “necessary wildlife habitat”. In one project, residential development was restricted to below a certain elevation and the upper lands had to be conserved through a conservation easement. The single residential development near the maternity colony captured Indiana bats on site, and the developer was required to minimize forest conversion and build in the open fields.

VFWD responses to Act 250 conflicts are directed by written mitigation guidelines that define necessary habitats, set population goals, and establish alternative mitigation requirements for particular species. Guidelines currently exist for black bear habitat, deer wintering areas, heron rookeries, vernal pools, and wetlands. Indiana bat mitigation guidelines are to be prepared this winter.

Forestry and agriculture are often more exempt from habitat protection measures, with the exception of the Burlington Electric Department’s wood chip harvesting program to produce electricity for the city. Each harvest job is reviewed by VFWD for impacts to roosting and foraging habitat.

Both permit procedures often require that remaining forestland be managed to benefit Indiana bats. In response, VFWD has prepared draft Forest Management Guidelines to be applied to the lands to be maintained as Indiana bat habitat. These guidelines can be provided for your review.

At this point in time, VFWD considers Indiana bat hibernating, roosting, and foraging habitat as “necessary wildlife habitat” deserving protection during land use permit reviews. What is less clear are:

- What level of impacts to roosting and foraging habitat are insignificant? How much roosting and foraging habitat do Indiana bats need to maintain their population?
- What measures are appropriate to reduce impacts to these habitat uses?
- What mitigation strategies can be effectively applied to compensate for any impacts?

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