Introduction
Hummingbirds are native treasures we could potentially all enjoy in our backyards. However, as a group, hummingbirds are jeopardized by human development. Of ~340 known species, 68 are Red listed (IUCN 2006). But development and biodiversity need not be conflicting, and urban areas may actually provide valuable surrogates for degraded habitats.

Our knowledge of community ecology can and should be applied to conservation in the wild, and reconciliation (Rosenzweig 2003a, b) in urbanized areas. The Tucson Hummingbird Project (THP) is a citizen-science, reconciliation ecology project aimed to study community ecology, monitor and conserve hummingbirds in Tucson, Arizona.

Methods
> We recruited project participants from the local community, mainly birders and docents at the Arizona-Sonora Desert Museum (fig. 1).

> These citizen scientists collected hummingbird data in their backyards once weekly, for 30 minutes in the morning.

> Initial registration included: address, details on yard landscaping, hummingbird plants and feeders.

> Participants were then sent instructions, a hummingbird guide and coupon to buy feeders.

> They reported hummingbird’ abundance, foraging preferences, and behavior.

> To increase data reliability, we analyzed only data on males, which are easier to identify.

> All communication and data report were done via the project’s web site.

Results
1. Four species of hummingbirds are most abundant in Tucson:

- Anna’s and Black-chinned hummingbirds were involved in a significantly higher proportion of Intraspecific chases vs. interspecific chases (table 1).

2. While Anna’s and Black-chinned hummingbirds were abundant throughout Tucson, Costa’s and Broad-tailed hummingbirds were found predominantly in less populated areas, closer to natural habitats. Costa’s was more abundant in the west and Broad-tailed more abundant in east Tucson (fig. 2). These results resemble findings of the Tucson Bird Count (Turner, 2004).

What can we do to change these patterns and increase diversity of native hummingbirds in cities?

3. What is the relationship between hummingbird abundance and diversity?

- Hummingbird diversity increased with population size (Linear regression, R² = 0.5641, Log N = 0.0411).

- However, Fisher’s a (Fisher et al. 1943) was independent of sample size (Linear regression, a = 0.0086 Log N = 0.8469, R² = 0.0796).

- Therefore, in order to eliminate sampling effect, we used Fisher’s a in all further analysis.

4. How do landscape and feeders affect hummingbird diversity?

- An average participant had two feeders and 2-3 hummingbird species.

- Diversity increased as the number of feeders increased (fig. 3a, 3c).

- Landscape types in the various yards included one or more of the following: natural desert, native xeriscape, non-native xeriscape, other, and bare yard.

- Yards with more landscape types had a higher diversity (fig. 3b, 3c).

Discussion
Community Ecology
Results suggest how hummingbird communities are organized, and explain how artificial and natural resource availability and community ecology are affecting their distribution in an urban area.

Hummingbird diversity (rather than merely abundance) increased with the increased amount of food.

We propose Aggressive Feeder Neglect as the mechanism underlying these results.

Powers & McKinley (1994) report that when food was unlimited, more intraspecific intruders were chased. (see also Brown et al., 1984).

We found that this is species dependent. Some species chase conspecifics significantly more than heterospecifics, while other don’t.

Reconciliation Ecology
This project demonstrates how we can reconcile a city in regards to hummingbird habitats.

We designed and tested a model system to monitor, conserve and augment native species, and provide stop-over habitats for migrating ones.

Citizen Science and Outreach
The latter was achieved with citizen scientists via a large-scale outreach to the local community.

Projects such as the THP can and should serve to increase environmental justice and education.

Indeed, following the success of the THP, 2 similar projects have been designed and are about to be implemented in K-12 schools in Tucson.

Hypothesis
When resources are high (such as large number of feeders), competitive aggression among the hummingbirds will increase. This will result in an “Aggressive Neglect” of the feeders, permitting access of other species to the feeders.

* term adapted from: Udvardy, 1951, Hutchinson, & MacArthur 1964

Table 1. Observed # of intraspecific vs. interspecific interactions. Expected number of intraspecific chases was generated by accounting for the relative abundances of each sp. per yard and the subsequent chase probability.

<table>
<thead>
<tr>
<th>Interacting species pair</th>
<th>Observed</th>
<th>Expected</th>
<th>Fisher’s combined P</th>
<th>P</th>
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<tbody>
<tr>
<td>Anna’s &amp; Black-chinned</td>
<td>42.509</td>
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<td>Broad-tailed</td>
<td>4.230</td>
<td>NS</td>
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</table>

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