RATES OF COLONISATION BY BIRDS AFTER AFFORESTATION

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INTRODUCTION

The Auroville plateau in Villupuram district of Tamil Nadu, India was a wasteland when the community was started in 1968. The land was criss-crossed with ravines, and the areas surrounding these were subject to heavy soil erosion, with overgrazing taking place over most of the area. Large tracts of land had palmyra (*Borassus flabbifer*) as the only vegetation cover.

Considerable effort was expended in reforesting the plateau, and over 1500 ha have been afforested until now. In the initial years, *Acacia auriculiformis* was the main species planted. In recent years the trend has been to plant indigenous species. Over a hundred species of trees indigenous to the area have been successfully planted in the past fifteen years. There are areas where natural regeneration has occurred alongside the plantations, and forests of many different ages are now extant.

This afforestation has resulted in a tremendous increase in the bird fauna. Early records prior to 1972 show a total of 25 species found, which is the same number still found on the patches of barren land. We updated the bird lists for Auroville recently and found 105 species present. The increase is linked with the variety of habitats available.

From a biological point of view, species numbers are linked to the size of areas of given habitats available. With increasing areas of habitat available the numbers of species also increase, in a logarithmic fashion. The two phenomena that operate are colonisation and extinction: in the sense that a species disappears from a patch where it was found earlier. When the extinction rate reaches the colonisation rate, an equilibrium number of species is found at a site (Wilson, 1967). In this paper we

attempt to see if this equilibrium has been reached, and whether there are any patterns to the bird fauna found at different sites.

METHODS

Transects were established at four sites in Auroville, where large scale planting commenced at different times. These are Aranya (AR)(3 years old), Aurodam (AU) (14 years), Pichandikulam (PI) (about 20 years) and Forecomers (FO) (about 27 years). A total of eight transects at each site were done. Transects were not necessarily straight.

At each site, the area was walked in the mornings and evenings between December and April: thus winter migrants have also been recorded. A list of all the birds seen was kept, including repeat sightings. The number of birds seen was plotted against the number of species seen. When this curve became level it was assumed that a fairly complete list of the site had been obtained. For analysis, CurveExpert 1.34 (Hyams, 1997), Excel 97 and MVSP 3.0 (KCS, 1998), were used.

RESULTS AND DISCUSSION

The number of species seen has been plotted against the age of the afforested area in Fig. 1. The number keeps increasing with the age of the plantation, but it can be seen that the curve levels off. At 15 years species are being added at the rate of about one every two years; by the time the afforested areas are 30 years, the species accumulation will drop to about one species every 5 years. With species disappearing, the equilibrium number of species is estimated at around 75. As can be seen from the graph, 15 years is about the time it takes for an afforested area in this region to acquire a relatively complete bird fauna. It must be noted, though, that in this preliminary analysis effects due to

the size of the afforested areas have been ignored. All ecological parameters have also been ignored in this preliminary analysis.

The best fit model to the data is a Weibull distribution (Hyams, 1997), which has the desirable feature of reaching an asymptote. The equation is:

$$Y = a - be^{-cx^{\wedge}d}$$

Where Y is the number of species, x is the age of the plantation, and a, b, c, and d are fitted parameters. The values obtained were a=84, b=245.6, c=1.618 and d=0.186. The number of species at each site is expected to stabilise at around 84.

How similar are these bird faunas, and how does plantation age affect the types of birds found at a spot? Plot age has been plotted against the proportion of unique species (species present only in that particular plot). Fig. 2 displays this graphically. Aranya, which has the lowest species richness, also has the highest proportion of unique species. A shift in the types of birds seen here compared to the other sites is noticeable. The faunas from FO, PI and AU (the three older plots) can be seen to be similar. Analysis shows that there are more species in common than would be expected by chance, which implies that the faunas appear to be converging.

Similarity indices based on presence-absence data, calculated as

No. of species in common to both sites/ Total number spp. at both sites combined) tend to strengthen the hypothesis that the bird faunas for the three older sites tend to become similar. (Fig. 3). The Aranya plot is dissimilar from the others (AU, PI and FO), while these three are very similar to each other.

Correspondence analysis was done for these plots and the results are given in Figs. 4 and 5. Factor 1 appears to represent an ecological gradient representing the shift from grassland to forest. Factor 2 appears to represent tree size. Factor 3 may be linked to overall diversity because large extents of *Acacia* monocultures were planted at Pichandikulam. These are, again, preliminary results and need validation by introducing ecological parameters into the analysis.

What are the actual species that appear and disappear? A look at the species that are found only at one site is instructive. Aranya has the common babbler (*Turdoides caudatus*), Indian bustard quail (*Turnix suscitator*), Indian jungle nightjar (*Caprimulgus indicus*), tree pipit (*Anthus hodgsoni*), redwinged bushlark (*Mirafra erythroptera*), Rufoustailed Finchlark (*Ammomanes phoenicurus*) and white eyed buzzard (*Butaster teesa*). As can be expected, most of these are open country species. Some of them have been noted at other places in Auroville as well, but have not been encountered in the formal surveys. The little egret (*Egretta garzetta*) is the only species recorded only at AU; the Besra sparrow hawk (*Accipiter virgatus*), a bird of lightly wooded country, has been found both at AU and PI. The blue chat has been recorded only at PI. Finally, the birds exclusive to FO are the barn owl (*Tyto alba*), grey quail (*Coturnix coturnix*), jungle bush quail (*Perdicula asiatica*), and shorteared owl (*Asio flammeus*). Apart from the last one, the others are forest birds.

CONCLUSIONS

Previous studies in plantations have shown very poor bird faunas. Khan (1980) found much lower bird diversities in tea compared to adjoining natural forest. Gandhi (1989) compared avifaunas of natural scrub near Chennai with Eucalyptus, cashew and casuarina, and found significantly reduced species richness in the latter three. Premdas (1990) found 44 bird species in shola patches in the Upper Palnis, compared to 6 in Eucalyptus, and 7 each in wattle and pine.

In this instance, the number of species actually increased. This is because indigenous species were used, and a very large variety was also used. The results shown here are similar to those found by Shankar Raman et. al. (in press), who found that forests regenerating after slash and burn agriculture showed a similar pattern of recovery for the avifauna, also with species richness stabilising after 15 years. If large scale afforestation is to have a positive ecological impact, then a mix of a large variety of indigenous species is necessary.

It is also worth noting that regeneration occurred naturally in places where *Borassus flabiffer* was present. Birds used to rest on these trees, and defaecated seeds germinated when grazing and browsing were eliminated. A clump of vegetation would start with the *Borassus* as the nucleus, and spread from there.

A similar pattern has been seen in the Nilgiris, with Rhododendron acting as the nucleus for shola regeneration. It is likely that each climatic and vegetation type has at least one of these "aunt" species.

While there is no quantitative data to support this now, this phenomenon would well repay intensive investigation. This is because large-scale afforestation efforts could be done cheaply by using sparse plantations of these aunt species.

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FIGURE LEGENDS

1. Increase in species number with age of plantation. The data fit a Webull distribution, which is plotted.
2. The number of species found only at one site, as a function of the age of that site.
3. 3. The similarity between pairs of plots of different ages.
4. Correspondence analysis for the data on the four sites, showing factors 1 and 2. Detrending has not been used.
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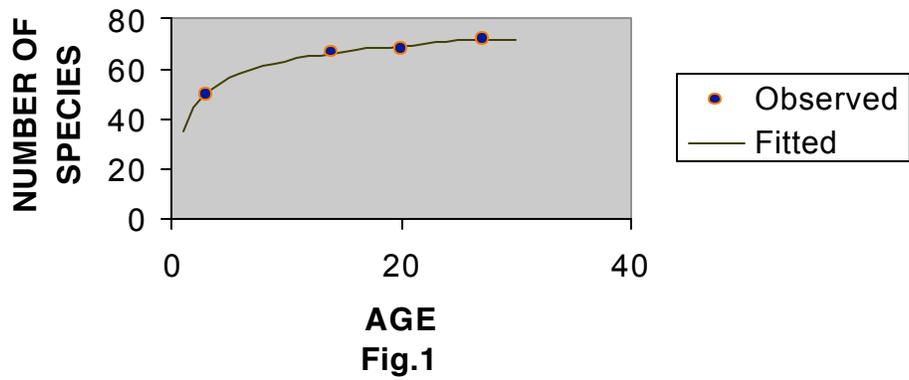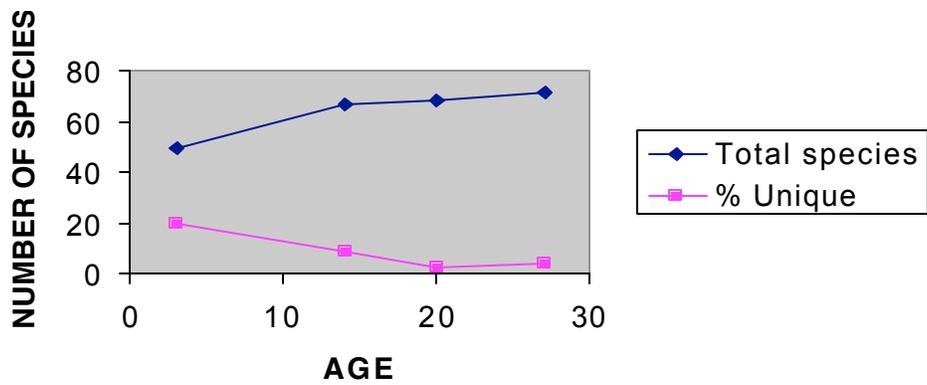
INCREASE IN SPECIES NUMBER WITH AGE

Fig.1

UNIQUE SPECIES

Fig.2

SIMILARITY INDICES FOR DIFFERENT PAIRS OF SITES