ASSESSMENT OF THE IMPORTANCE OF PLANTATIONS FOR THE ARAUCARIA TIT SPINETAIL (*Leptasthenura setaria*) IN ARGENTINA

By

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A THESIS PRESENTED TO THE GRADUATE SCHOOL
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To my parents, Ricardo and María Rosa.

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I assessed occupancy and density of the near threatened Araucaria Tit Spinetail (*Leptasthenura setaria*) in Araucaria forests and Araucaria plantations of Misiones, Argentina. All natural patches were occupied by Araucaria Tit Spinetails and only 85 % of the plantations were occupied. However, density was almost three fold higher in plantations compared to natural forests. In plantations, occupancy was best predicted by age and density by a model including age and isolation. A more detailed analysis showed lower densities in plantations < 10 years old compared to older plantations. Overall, my results indicate that plantations may be good habitat for the Araucaria Tit Spinetail. Restoration of natural remnants and conservation of old, connected plantations in Argentina may assure the protection of significant populations of spinetails and other bird species associated with *Araucaria*.

CHAPTER 1
INTRODUCTION

Habitat loss and fragmentation are considered major threats for conservation of biodiversity. Most of the Earth's surface (83 %) has been transformed by human activities in the last century (Sanderson et al. 2002), leading to substantial population declines in species and sometimes to extinction. In particular, deforestation is a globally significant concern, as almost half of the terrestrial plants and animal species live in forests (Brockerhoff et al 2008). Habitat restoration has been proposed as one of many measures to remedy loss of the forest cover (Chazdon et al. 2008), but this practice is poorly developed in third world countries where costs may be prohibitive and conservation efforts are oriented toward protection of remnant forests.

Although deforestation is still high, the rate of forest loss declined from 2000 to 2005 worldwide (FAO 2007) mostly because of an increase in the area of plantation forests, leading to the question of how suitable are plantations as potential habitat for indigenous species. Work with birds has demonstrated that plantations generally have lower species richness and diversity compared to native forests (Lindenmayer and Hobbs 2004, Barlow et al. 2007, Bus de Warnaffe and Desconchat 2008). Structural complexity of native forest may increase the diversity of habitats, shelter and food availability and has been cited recurrently as the main factor affecting bird diversity (Clout and Gaze 1984, Duran and Kattan 2005, Barlow et al. 2007). However, recent studies suggest that stand age, management practices, and the surrounding landscape may influence the biodiversity value of plantations (Loyn et al 2007, Luck and Korodaj 2008, Brockerhoff et al. 2008). Compared to other agricultural matrixes, plantations might provide not only surrogate habitat for many species (Brockerhoff et al. 2003; Barbaro et al. 2005; Carnus et al. 2006), but increase connectivity between remnant forests (Hampson and Peterken 1998, Norton 1998) and buffer edge effects (Renjifo 2001, Fischer et al 2006).

Commercial plantations are intrinsically fragmented and transient habitat. Studies on habitat loss and fragmentation in other ecological systems have shown that habitat variables at the patch and landscape scales influence distribution of species. Patch size, patch shape, and habitat quality are important determinants of regional persistence in fragmented landscapes (Offerman et al. 1995, Turner 1996, Laurance et al. 2002, Debinski and Holt 2003, Parker et al. 2005, Schooley and Branch 2007). At a landscape level, habitat loss increases isolation through a reduction in amount of available habitat in the landscape and changes in habitat configuration and, consequently, affects dispersal. Dispersal among patches influences population viability and is a critical process for maintenance of metapopulations (Hanski 2004). Most studies of habitat fragmentation have been conducted in remaining natural habitat. However, the often simplified nature of plantation ecosystems facilitates testing hypotheses and increases the inference of studies at patch and landscape scales. Variables like stand size, age and density, as well as isolation, are easily and accurately quantifiable in these landscapes generated by human activity.

The Atlantic Forest of South America is among the most diverse and threatened ecosystems of the world. This forest, which encompassed coastal rainforests to semideciduous forests of the interior, originally covered around 1.5 million km^2 in Brazil, eastern Paraguay and northeastern Argentina. One of the endangered forest types within the southern part of the Atlantic Forest is Parana Pine forest also known as Araucaria (*Araucaria angustifolia*) forest. The Araucaria tree, which dominates this forest, is a critically endangered species (IUCN 2006) that occurs in temperate areas from 600 to 1,200 m in Southeastern Brazil and in the east of Misiones Province, Argentina. Loss of these forests has led to severe declines in fauna associated with Araucaria forest, but these declines have not been well documented. In Argentina, plantations of *Araucaria angustifolia* have been established since the early 1950s and at present, they cover an area at least 15 times larger than natural Araucaria forests. Declines of some species that inhabit Araucaria forest may have been buffered by Araucaria plantations. However, the lack of an adequate timber market and the slow growth rate of these trees is leading to replacement of these plantations with Loblolly pine (*Pinus taeda*). Araucaria plantations comprised around 40,000 ha in 2001. Recent estimates indicate this area has decreased by more than one half, highlighting the need to determine the value of Araucaria plantations for native species.

The Araucaria Tit Spinetail (*Leptasthenura setaria*) is an insectivorous passerine bird that exclusively inhabits the canopy of Araucaria forests. This species has been recorded in Araucaria plantations in recent years, expanding its known distribution in Argentina (Krauckzuk 2001, Cabanne 2007). Although plantations are highly fragmented, they constitute most of the remaining habitat for the species. At least three other species of birds are associated with the Araucaria forest (*Amazona pretrei, Amazona vinacea, Cyanocorax Caeruleus*) but these species already are so scarce that only anecdotal sightings can be collected. The goals of this study were to: 1) compare the occupancy and density of Araucaria Tit Spinetails in natural remnants and plantations and 2) model density and occupancy of the Araucaria Tit Spinetails with respect to habitat variables in plantations and the surrounding landscape. By identifying habitat variables related to distribution and density of spinetails, this study provides a scientific basis for managing current Araucaria stands and assessing the potential impacts of their loss and replacement by introduced pines.

CHAPTER 2
METHODS

Study Area

My research was conducted in a study area of about 30,000 km^2 in the province of Misiones in northeastern Argentina (Fig. 2-1). This area has an E-W altitudinal gradient ranging from the Araucaria montane forest (900 m) to lowland broadleaf forests (150 m) and encompasses the range of forest of *Araucaria angustifolia* and plantations in Argentina. Natural remnants comprise approximately 19 stands highly connected by an agroforestry matrix and isolated Araucaria trees, with numerous small stands outside protected areas and some larger stands occurring in protected areas (Rau 2005). Density of Araucaria trees in forest remnants averages about 6 individual ha^{-1} (Rau 2005, Ríos 2006). Plantations are scattered among natural remnants and also occur outside the natural range of *Araucaria* in northwest Misiones. Density of trees in plantations ranges from 150 to 1500 individuals ha^{-1} depending mostly on management and age of the plantation. Most of the plantations have been managed to produce timber on rotations of 25-30 years. Silvicultural practices include pruning and thinning.

Site Selection

The locations of natural remnants were obtained from a recent assessment conducted by Rau (2005) and all remnants were surveyed (N=19, Fig. 2-1). Locations of Araucaria plantations were mapped from digital aerial photographs (1:30.000, 2007). Sixty two plantations between 1 and 435 ha in size and between 4 and 60 years old were selected randomly to encompass the wide array of sizes, ages and isolation of plantations. Plantations were considered different patches if distances between them were larger than 0.8 km, which is the median dispersal distance of several passerines similar in size to the Araucaria Tit Spinetail (D'eon 2002).

Density and Occupancy Data

I assessed density and occupancy of the Araucaria Tit spinetail in plantations and natural forests using point counts and playbacks. Points were separated by at least 250 m. If the area of the plantation was between 1 and 5 ha, one point was located at the approximate center of the patch. I randomly selected other two additional points if the patch was large enough to meet the criteria for separation of points. If the plantation was larger than 5 ha., I systematically placed transects (1000-m length) located at least 250 m from each other and 50 m from the edge of the patch. I selected three random points for point counts and playback in each transect up to a maximum of nine points per plantation (N of point counts=150). Because natural remnants were not always discrete patches and the density of Araucaria trees was low, in remnants I followed the sampling criteria established for large plantations, but point counts (N=45) were made at the closest Araucaria tree to the randomly selected point.

Araucaria Tit spinetails are highly mobile and are easily detected by their characteristic vocalizations in the top of Araucaria trees. Therefore, density of spinetails was assessed with point count surveys of 5-minutes duration using a snapshot approach in which the observer attempts to record the locations of detected birds at a snapshot moment, with time spent before this moment identifying and locating birds and afterwards confirming locations (Buckland 2006). Distances to birds from each point were recorded with a rangefinder. Surveys were conducted from September 2007 to January 2008 between 700-1100 h and 1500-1800 h on non-rainy and non-windy days.

After point counts were obtained, occupancy was assessed at the same points with 5 minutes of playback. Given that detectability of the species using playback was 98.4 % in a pilot study, once the species was detected, no further surveys of that site were conducted. Birds were considered to be absent if no birds were detected after three surveys of the point, each separated by at least 8 hours.

Measurement of Predictor Variables

I measured predictor variables for analyzing factors affecting species distribution at patch and landscape scales in plantations. Because of the small number of remnants and high occupancy (100%), factors that affect occupancy and density of remnants were not assessed. At the patch scale I included measures of plantation area, stand age, and understory height and density. Understory height and density were recorded at a randomly placed point within a 10-m radius of the location of point counts by recording the number of vegetation contacts on a 20-mm diameter pole marked in 10-cm increments. Understory measurements were taken at one point in small plantations (1-5 ha) and three points in large plantations (>5 ha). Stand age was determined based on records from timber companies and landowners, and I generated a categorical variable of four levels of plantation age: 1) 4-9 years old, 2) 10-15 years old 3) 16-25 years old, and 4) more than 25 years old (Table A-1).

For landscape scale analysis, I used three different measures of isolation for each plantation that served as a focal patch: i) distance to the nearest plantation (NN), ii) mean distance to the 3 nearest plantations (THREE), and iii) amount of available habitat (hectares of Araucaria plantations) surrounding each focal patch, calculated by establishing a buffer of 5 km around the plantation (BUFFER). Because birds were not surveyed in all plantations, I did not distinguish between occupied and unoccupied patches in isolation metrics. Plantation area and landscape variables were calculated using ARCGIS 9.2.

Statistical Analysis

I used a classification tree to model occupancy in plantations with DTREG (Sherrod 2003). This modeling procedure involves recursively partitioning of a data set into increasingly homogeneous subsets (nodes), with each split defined based on the value of a single predictor variable (Breiman et al. 1984, De'ath and Fabricius 2000). At each split, each predictor variable entered into the model is assessed independently and the variable that generates the greatest improvement in homogeneity of the two resulting nodes is selected as for splitting the node. Then the value for this variable that minimizes heterogeneity in the daughter nodes is used as a threshold value for segregating the data. This method is especially appropriate for complex datasets that include imbalance and nonlinear relationships. I included age and size as potential predictor at the patch level in the model building. I ran three simple classification trees each with these two predictors and a different isolation metric. Because some of my landscapes units were spatially clustered, I also added geographical location (x, y geographic coordinates) as another variable to assess potential effects of spatial location of samples.

I used a Gini goodness of fit measure to determine optimal split and a minimum node size of 10 observations was required to perform a split and avoid over-fitting. Trees were constrained to the number of nodes allowed for one standard error from the minimum relative validation error (cross validation error cost relative to a one-node tree), which was calculated using v-fold cross validation. Model adequacy was assessed in two ways based in the percentage of data that were correctly classified and, because classification accuracy is sensitive to the relative frequency of occupied patches, the models also were assessed using Cohen's Kappa (K) statistic. Kappa adjusts for bias associated with random model agreement by measuring the actual agreement minus the agreement expected by chance, given the frequency distribution within the data set (Cohen 1960, Fielding and Bell 1997).Values of K can be used to classify model agreement as poor ($K \leq 0.4$), good ($0.4 \geq K \leq 0.75$), or excellent ($K \geq 0.75$, Landis and Koch 1977).

Estimates of absolute densities of spinetails in forest remnants and plantations that ranged from 10 to 60 years were obtained with DISTANCE 5.0. Plantations of this age were analyzed because I wanted to match structure of plantations to natural remnants. No natural remnants were comprised of young trees. I detected the species only in 16 of 45 point counts in forest remnants. Therefore, I modeled a global detectability function for both plantations and natural remnants and ranked the models following Akaike Information criteria. Encounter rate, rather than detection probability, was the main source of variation in both forest remnants and plantations supporting the use of a global detectability function for the different types of habitat. The density of birds in plantations was modeled with respect to habitat variables using a Poisson generalized linear mixed model where two patch variables (stand age and plantation size) and one landscape variable (isolation) were fixed factors and the identity of the plantation was a random effect. For this analysis I used PROC GLIMMIX in SAS 9.2 (SAS Institute Inc.), which allows one to obtain true log likelihood estimates. Among the fixed factors only the nearest neighbor metrics and the amount of available habitat in the buffer (BUFFER) were correlated (Table A-2). Understory height and density were positively correlated with stand age ($r>0.58$) and with each other ($r=0.86$; Table A-3) and, therefore, both understory variables were excluded from the models. I ran a total of 15 models (Table B-1). Models were ranked following the Akaike Information Criteria. To assess the potential effects of spatial location among samples, I added geographical location (x, y geographic coordinates) as another variable and compared the best ranked model with and without this variable.

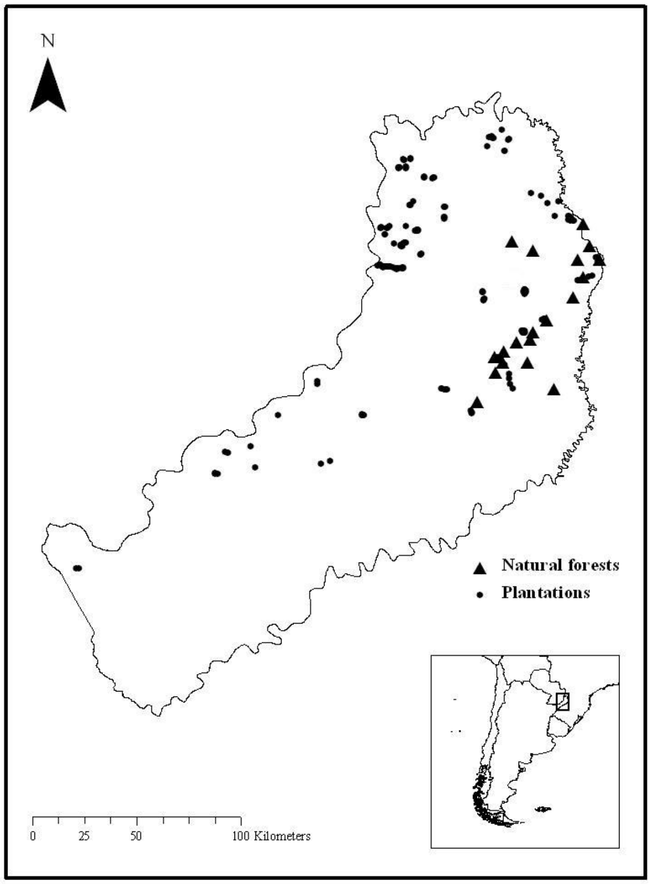

Figure 2-1. Location of natural forests and plantations where surveys were conducted in the study area.

CHAPTER 3
RESULTS

Although all natural patches were occupied by Araucaria Spinetails, only 85% of the plantations were occupied. The final classification tree showed two terminal nodes after pruning and age was the only predictor variable (Fig 3-1). Plantations younger than ten years old had lower occupancy rates. This model showed 81.9% agreement with the data (Table 3-1) and the Kappa statistic (K=0.49, SE= 0.12) indicated a good model agreement with the data. classification accuracy of this tree was 81.9 %.

Densities were almost three times higher in plantations than in natural remnants [density (CV %), 95 % CI - Plantations, 0.94 ind. ha^{-1} (14 %), 071-1.23; Natural forest 0.36 ind. ha^{-1} (29 %), 0.20-0.64]. The model that best fit the data was a hazard rate function with a polynomial series adjustment (Kolgomrov-Smirnov GOF p=0.37). Abundance of spinetails in plantations was best predicted by age which had an overall weight of 0.99. I ran a Tukey test of least squares means to compare abundances with respect to age. Young plantations (4-9 years) showed lower abundances and were different from all the other categories of age (10 and greater) (ind. ha^{-1} – 4-9 years, 0.15; 10-15 years, 0.74; 16-25 years 1.08; >25 years, 0.88) ((Table 3-3). A model with age and the nearest neighbor metrics ranked first, followed by a model considering age and the amount of available habitat in a buffer (Table 3-2). These two isolation metrics were the most correlated (Table A-2). Models considering isolation as the only predictor variable ranked poorly (ΔAIC>17). Incorporation of geographic location did not improve the best model.

Table 3-1. Confusion matrix for the classification tree model for plantations.

	Predicted category		
	Occupied	Unoccupied	
Actual category			Misclassified
Occupied	41	10	19.60%
Unoccupied	1	8	11.10%

Table 3-2. Models of abundance of Araucaria Tit Spinetails in plantations ranked with Akaike Information Criteria.

Modelo[a]	k	AICc	ΔAICc	*wi*
AGE+NN	3	297.07	0	0.344
AGE+BUFFER	3	298.04	0.97	0.211
AGE	2	298.78	1.71	0.146

[a]Models with $\Delta_i \leq 2$ are presented. K = no. explanatory variables plus 1, $\Delta_i = AIC_{ci}$ – minimum AIC_c, and w_i are Akaike weights.

Table 3-3. Differences in abundance of Araucaria Tit Spinetails by age of the plantation. Abundance estimates were derived from the Poisson regression model

Age comparison	Estimate	Standard error	DF	t value	Adj. p
4-9 y vs. 10-15 y	-1.41	0.52	131.0	-2.72	0.048
4-9 y vs. 16-25 y	-2.04	0.51	131.0	-4.00	0.001
4-9 y vs. >25 y	-1.8	0.45	131.0	-3.97	0.002
10-15 y vs. 16-25 y	-0.62	0.42	52.8	-1.48	0.46
10-15 y vs. >25 y	-0.38	0.34	52.7	-1.10	0.69
16-25 y vs. >25 y	0.24	0.33	28.8	0.73	0.89

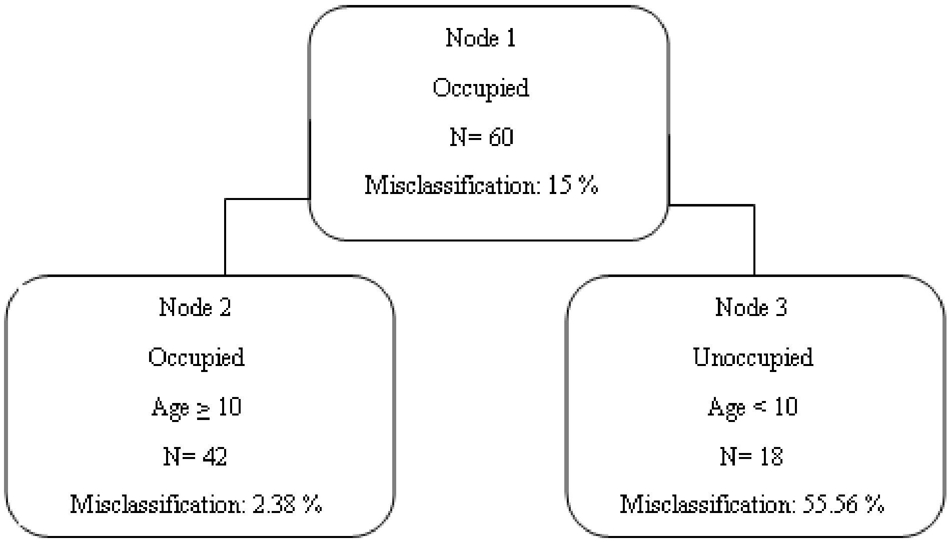

Figure 3-1. Classification tree for predicting occupancy of Araucaria Tit Spinetails. Total classification accuracy of this tree was 81.9 %.

CHAPTER 4
DISCUSSION

Previous research has indicated that natural habitats generally are better than human generated landscapes for wildlife (Lindenmayer and Hobbs 2004, Barlow et al. 2007, Bus de Warnaffe and Desconchat 2008). Although spinetails occupied 100 % of the remnants, density was three fold higher in plantations. High densities do not necessarily indicate high habitat quality (Van Horne 1983, Battin 2004) and habitat quality should be evaluated in terms of spinetail productivity. However, two other studies (Krauckzuk 2001 and Cabanne et al. 2007) report a ubiquitous presence of the species and high densities in plantations outside the natural range of *Araucaria*. Plantations may be good habitat for this species as suggested for several other threatened species (Kleinpaste 1990, Brockerhoff et al. 2005, Barbaro et al. 2008). The reason for higher spinetail density in plantations compared to natural forests is unknown. Differences in tree density may be one factor that explains differences between density estimates in these habitats. Densities of Araucaria trees in natural remnants generally are two orders of magnitude lower than densities in plantations, which can reach 500 ind. ha^{-1}. Degradation of Araucaria forests through selective logging has decreased densities of trees in natural remnants. In the 1940s, densities of 48 trees ha^{-1} were recorded in some of the locations surveyed in this study (Ragonesse 1946). By the 1960s, average density was estimated at only 12 trees ha^{-1} (Rau 2005), but still far above the highest densities found in natural areas by the 1980s (7 trees ha^{-1}, Gartland 1984, Ríos 2006).

The higher occupancy in natural forests than plantations may be related to a high degree of connectivity in natural forests. Many of the remnants were located less than 5 km from the closest remnant, with an intervening matrix that included plantations and isolated Araucaria trees. My observations in natural forests suggest that spinetails are present even at low densities of *Araucaria* in modified areas where the *Araucaria* is the only tree species remaining. I recorded these birds flying between trees separated by distances of 81 m. Joenck (2005) also reported flights of 84 m between Araucaria trees in modified areas. This observations suggests the spinetails might be able to move among the canopies of relatively isolated individuals.

Age influences occupancy of spinetails in plantations, and birds were mostly absent in stands less than 10 years old. These plantations generally are unoccupied even at distances less than 50 m from mature occupied plantations, indicating the spinetails do not usually use plantations less than 10 years old. This result is consistent with other studies that show that older plantations exhibit higher diversity and abundance of birds through enhanced habitat structure (Luck and Korodaj 2008, Brockerhoff et al. 2008). Recent studies in natural forests also indicate that invertebrate fauna is more diverse and abundant in larger trees, resulting in higher abundance of insectivorous birds (Berg et al. 1994, Díaz et al. 2005, Díaz in prep.). The only described nests of the Araucaria Tit Spinetail have been found at 20 and 25 m height in the top of Araucaria trees (Bóçon 1993). Larger trees may provide these birds a safe refuge against predators. Old trees dominate in natural stands, which might be another reason explaining the presence of spinetails in all remnants. Plantation area did not affect occupancy or density of spinetails. Range size in a related species in the southern temperate forest of Chile is estimated to be about 1 ha. /pair (Díaz et al. 2006). If area requirements are similar for Araucaria Tit Spinetails, this could promote persistence of this species in small remnants and plantations.

Isolation was not an important factor predicting occupancy. Models of abundance that included only isolation were ranked very low. A model with only age as a predictor was competitive with the highest ranked models that included isolation metrics (i.e, Δ AIC < 2). The large number and close proximity of plantations likely facilitated colonization of this species beyond its natural distribution. A closely related species, *Leptasthenura fuliginiceps,* displays seasonal movements in winter from the highlands to the lowlands of western Argentina (Narosky and Yzurieta 2003), suggesting that at least this species can make long distance movements when there is appropriate habitat. Surrounding habitat has been shown to play an important role in patch isolation. Land uses are similar across the area I surveyed in NE Argentina, and plantations and secondary forest are still important components of the landscape. In contrast, in Brazil small Araucaria patches are embedded in a hostile soy crop matrix and patches often are unoccupied even when potential source areas are as near as 700 m (Pietrek and Debarba in prep).

Occupancy of plantations was high in this study compared with previous estimates of 50 % occupancy in twenty plantations in the same study area (Cabanne et al 2007). I found these twenty plantations to be occupied. These differences are unlikely to reflect changes in occupancy, but rather the previous study relied on passive observations, which may result in lower detectability than playback which results in a detectability closer to 100 %. Although occupancy estimates from this study were high, because of the rapid loss of Araucaria plantations, distribution maps derived from these estimates may overestimate the area occupied by the species in the future. Furthermore as remaining plantations become more isolated, demographic rescue and recolonization are likely to decline, resulting in an increase in unoccupied habitat.

Distribution of the Araucaria Tit spinetails in Argentina is strongly associated with Araucaria plantations. Plantations not only encompass nearly 90 % of the remaining habitat but also exhibit high occupancy rates, though lower than natural forests, and high densities. Most of the remaining natural stands are old and natural regeneration is low in many of these areas threatening the viability of natural Araucaria tree populations (Rau 2005). Restoration of these forests and conservation of old, connected plantations in Argentina may assure the protection of significant populations of spinetails and other bird species associated with *Araucaria*. Araucaria trees not only provide a higher quality timber than pine and have an intrinsic biodiversity value, but also this species has a cultural value not fully appreciated. Araucaria seeds traditionally have been a key resource for aboriginal communities and are still harvested by local people in natural stands. The Araucaria tree increasingly has been incorporated as a flagship species in cities across its distribution. Araucaria forests and plantations in Argentina provide opportunity for community-based management in rural areas and for commercially oriented entrepreneurs to strengthen economic growth in an environmentally friendly manner while conserving the last of this forest.

APPENDIX A
ADDITIONAL TABLES

Table A-1. Characteristics of Araucaria plantations by category of age

	Age			
	4-9 years	10-15 years	16-25 years	>25 years
Mean tree height (SE)	8.8 (1.7)	11.9 (2.6)	16.3 (2.6)	20.5 (2.4)
Density (trees/ha)	800-1500	450-800	300-450	150-250

Table A-2. Correlation between patch and landscape variables in plantations.

	AREA	AGE	NN	BUFFER	THREE
AREA	1				
AGE	0.328202	1			
NN	0.043286	0.054341	1		
BUFFER	0.0993	0.048118	-0.51403	1	
THREE	-0.08825	0.110088	0.033594	-0.23912	1

Table A-3. Correlation between age and understory variables in plantations.

	Age	Understory density	Understory height
Age	1		
Understory density	0.51	1	
Understory height	0.59	0.86	1

APPENDIX B
MODELS OF ABUNDANCE

Table B-1. Models of abundance of the Araucaria Tit Spinetails is plantations ranked with Akaike Information Criteria.

Modelo	k	AICc	ΔAICc	*wi*
AGE+NN	3	297.07	0.00	0.34
AGE+BUFFER	3	298.04	0.97	0.21
AGE	2	298.78	1.71	0.15
AGE+SIZE+NN	4	299.33	2.26	0.11
AGE+SIZE+BUFFER	4	300.24	3.17	0.07
AGE+THREE	3	300.91	3.84	0.05
AGE+SIZE	3	300.97	3.90	0.05
AGE+SIZE+THREE	4	303.13	6.06	0.02
NN	2	314.18	17.11	0.00
BUFFER	2	315.23	18.16	0.00
SIZE	2	315.90	18.83	0.00
SIZE+NN	3	316.12	19.05	0.00
THREE	2	316.25	19.18	0.00
SIZE+BUFFER	3	317.49	20.42	0.00
SIZE+THREE	3	318.19	21.12	0.00

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BIOGRAPHICAL SKETCH

I was born in the city of Buenos Aires in 1979 and I grew up in the surroundings of this impressive metropolis. Since I was a child I have been deeply interested in ecological issues. I can still remember my enthusiasm when I spent my vacations in my relatives' ranch in the Argentine pampas or in the mountains of central Argentina; I was mesmerized by nature's diversity. Given my curiosity, my parents encouraged me to read about biology since an early age. As I learned more and more about ecology, I witnessed the replacement of original grasslands with crop fields in the Pampas. I saw the transformation of one of our most characteristic ecoregions. As an adolescent, I started to address my various inquiries not only to governmental agencies and NGOs dealing with environmental areas, but also to renowned conservation biologists in my country. When I had to choose a university program, I decided to pursue undergraduate studies in Biology at the Universidad de Buenos Aires, from where I graduated in 2004.

During my university studies I focused my attention on ecology at population scale, and at the same time I completed courses on population genetics in order to acquire a wider view of wildlife management. Through my interaction with university professors that encouraged me to formulate my own questions, I learned the principles of scientific reasoning and intensified my passion for research. In 2000, while I was still a student, I took part in the evaluation of the biological resources of Pampa del Indio Provincial Park (Province of Chaco). This project was conducted by the non-governmental agency "Aves Argentinas" (*Argentine Birds*), a representative of Birdlife International.

A year later, given my experience in this project, I worked as an intern at the National Parks Administration, Northeast Regional Delegation, where I studied issues concerning the System of Protected Areas of the Chaco province. In 2003, I travelled to the Argentine

Patagonia to do field work for my undergraduate thesis. My research topic was "Lizard susceptibility to predation in relation to loss of vegetation cover". During my research, I had the chance to work with Andres Novaro and Susan Walker former students of the University of Florida and zoologists of the Wildlife Conservation Society. This interaction allowed me to become better acquainted with the work done in the United States in my field of interest.

In 2004, I received a grant from the Neotropical Grassland Conservancy for the project entitled "Factors that predict the presence of the red winged tinamou (*Rhynchotus rufescens*) in the Argentine grasslands". At that time, I obtained a second scholarship from the Agency for Scientific Promotion and the National Institute for Agricultural Technology to participate in a project on the "Integration of two non-polluting techniques for tephritidae control" and for almost two years, I worked on the study of biologic control and sterile insect technique applied to the fruit fly (*Ceratitis capitata*).

In 2006 I was awarded with a Fulbright Scholarship to continue my studies in the US. At the University of Florida I found a program that fulfilled my expectations, and Dr. Lyn Branch, an exceptional and highly enthusiastic advisor who guided my first steps as a grad student. With her advice I am culminating my research that has focused on a threatened bird species in NE Argentina. I expect this study will be a cornerstone in my training to become an ecologist solving applied problems back home.