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Using Birds as Management Indicators in the HFQLG Area – Results from 2002 - 2006

Ryan Burnett

Plumas-Lassen Research Symposium

March 30, 2007

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Birds as Indicators in Adaptive Management

INNOVATIVE APPROACHES TO INTEGRATING WITH MANAGEMENT

- Applied adaptive research and monitoring
  - songbirds and spotted owls, shrubs, and aspen restoration

- Local and landscape factors influencing species abundance

- New landscape modeling techniques for uncommon species – MIS woodpeckers on the Lassen.

- Integration tools
  - white papers, interactive GIS tools, field trips, posters, presentations, and publications.

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Songbirds and Spotted Owl

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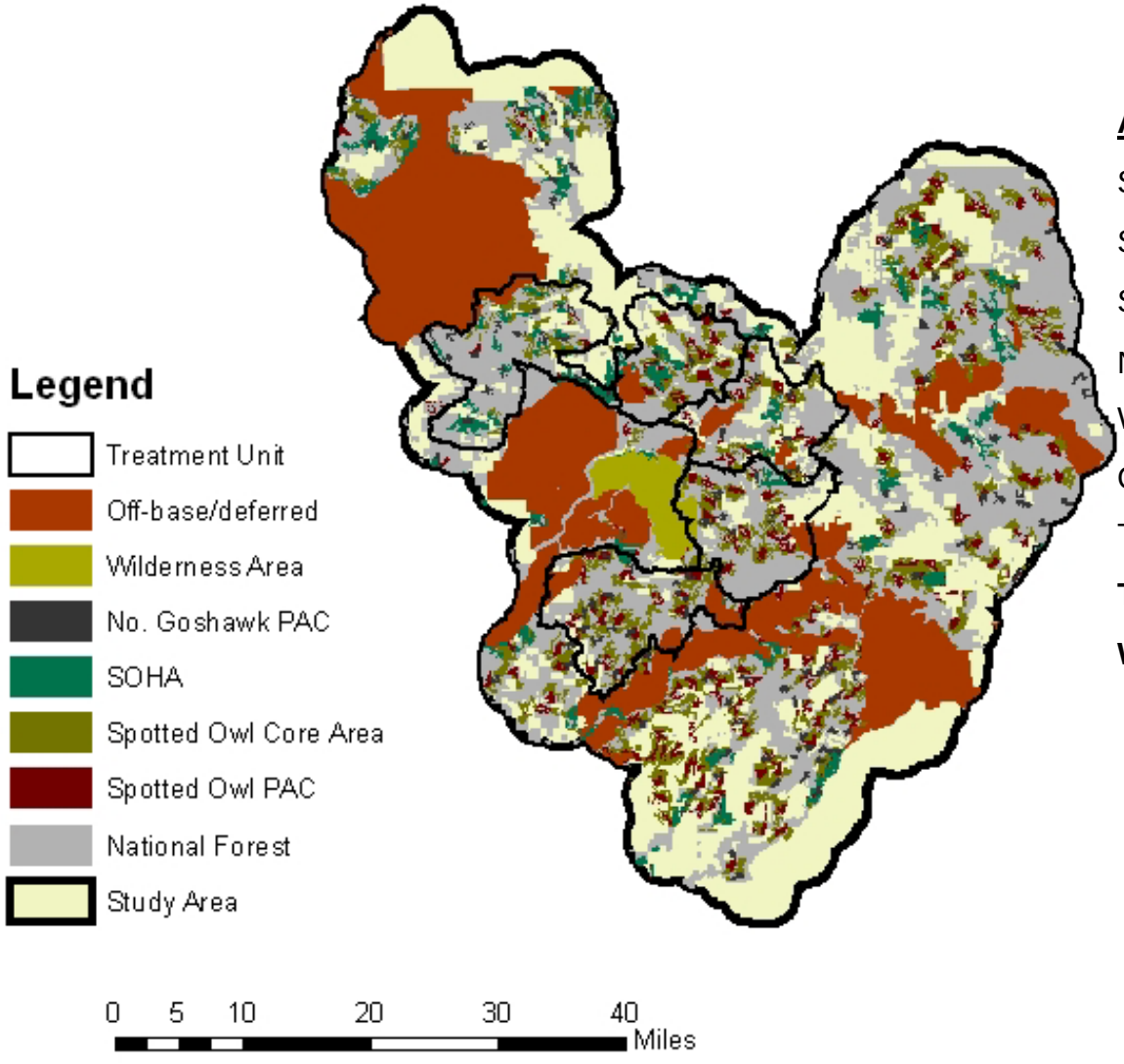
Land Allocations in the PLAS



Allocation	N.F. Land in Study Area	% of N.F. in Study Area
SPOW PAC	117,966	11.49
SPOW Core	204,939	19.95
SOHA	98,812	9.62
NOGO PAC	31,481	3.07
Wilderness	23,738	2.31
Offbase	291,884	28.42
Total	768,819	NA
Total - Overlap	**581,459**	**56.62**
W/O Core	**453,185**	**44.13**

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A suite of species as management indicators

1. Hermit Warbler
2. Oregon Junco
3. Mountain Chickadee
4. Audubon's Warbler
5. Dusky Flycatcher
6. Nashville Warbler
7. Western Tanager
8. Golden-crowned Kinglet
9. Red-breasted Nuthatch
10. Fox Sparrow
11. Hammond's Flycatcher
12. Cassin's Vireo
13. Brown Creeper
14. Warbling Vireo
15. MacGillivray's Warbler
16. Steller's Jay
17. Black-headed Grosbeak
18. American Robin
19. Spotted Towhee
20. Calliope Hummingbird

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Species More Abundant Outside PAC/Core Areas

Species	Outside Pac/Core	Inside PAC/Core	Ratio	P-value
Fox Sparrow	0.460	0.110	4.18	<0.001
Calliope Hummingbird	0.113	0.040	2.83	<0.001
Spotted Towhee	0.127	0.046	2.76	<0.001
Olive-sided Flycatcher	0.208	0.103	2.02	<0.001
Dusky Flycatcher	0.769	0.411	1.87	<0.001
Western Wood-Pewee	0.137	0.079	1.73	<0.001
MacGillivray's Warbler	0.202	0.130	1.55	<0.001
Mountain Chickadee	0.671	0.460	1.46	<0.001
Chipping Sparrow	0.099	0.074	1.34	0.076
Western Tanager	0.456	0.388	1.18	0.014
American Robin	0.118	0.105	1.12	NS
Audubon's Warbler	0.638	0.577	1.11	0.080
Stellar's Jay	0.137	0.123	1.11	NS
Nashville Warbler	0.137	0.123	1.11	NS
Red-breasted Sapsucker	0.100	0.090	1.11	NS
Oregon Junco	0.740	0.695	1.06	NS

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Nesting Guilds

Index	Outside Pac/Core	Inside PAC/Core	Ratio	P-value
Shrub Nesters	1.79	0.86	2.08	<0.0001
Cavity Nesters	1.37	1.24	1.10	0.026
Tree Nesters	3.90	4.63	0.84	<0.0001

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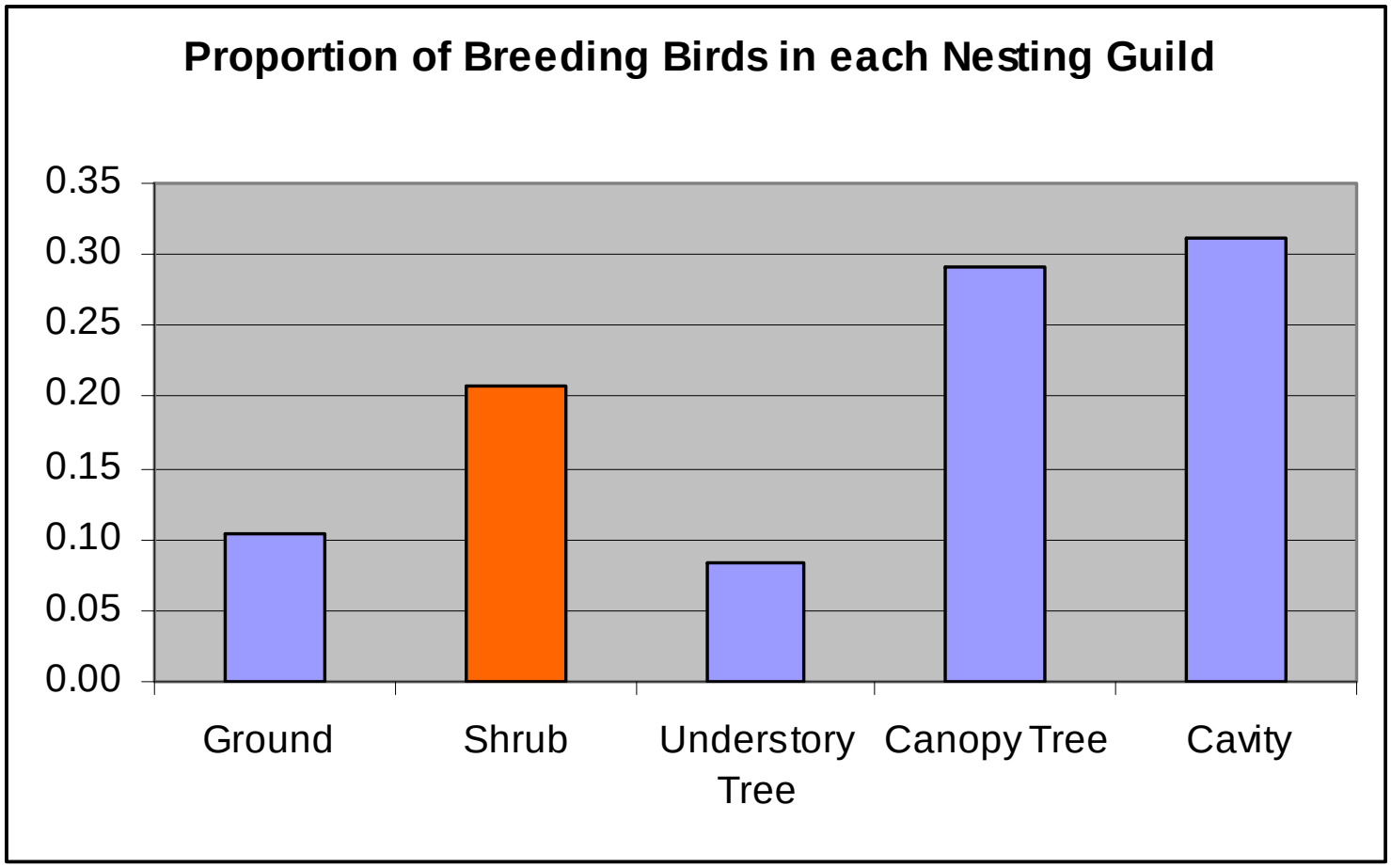
Shrub Habitats

Why Manage for Shrubs?



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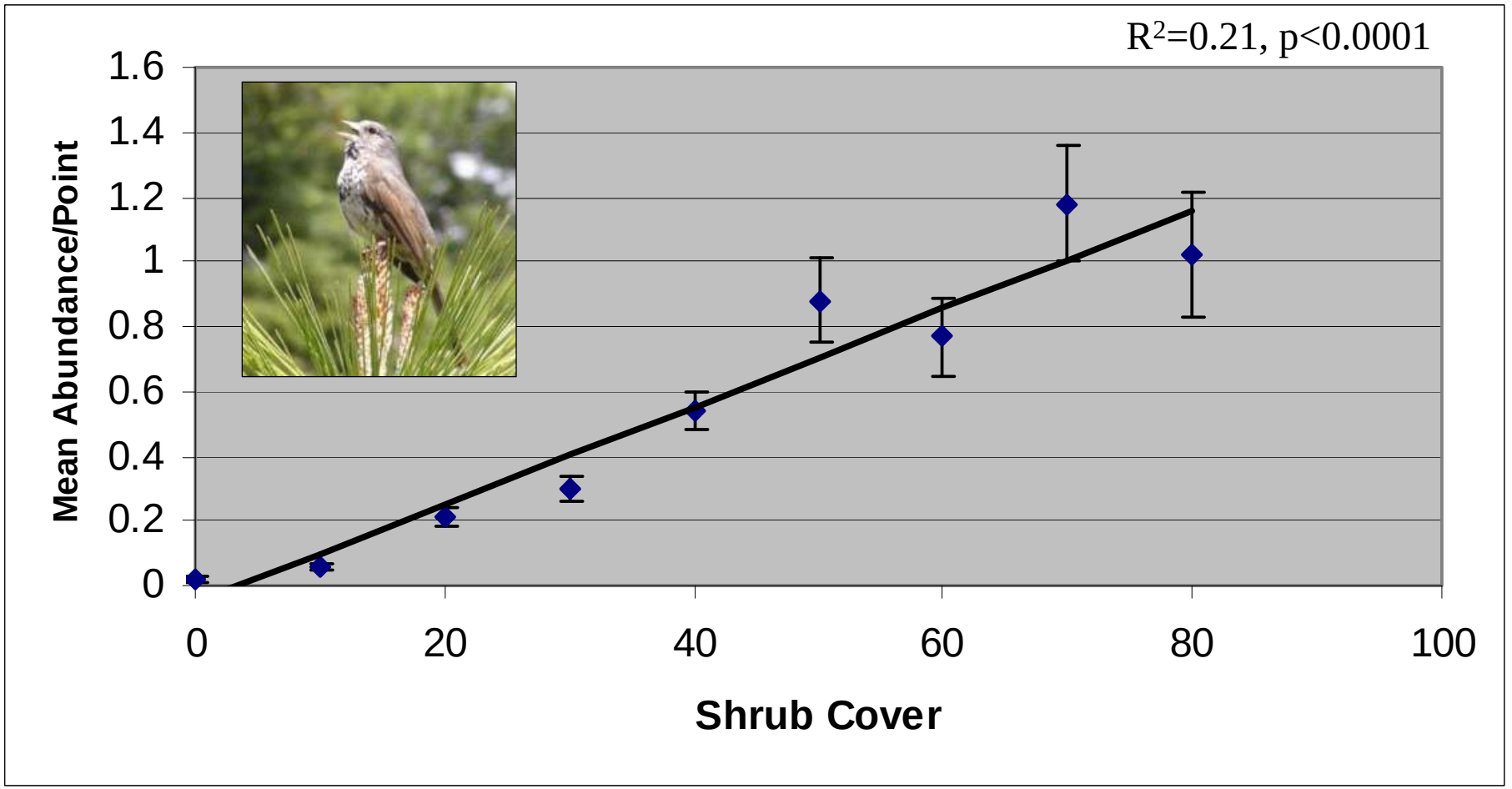
Fox Sparrow and Shrub Cover in the PLAS



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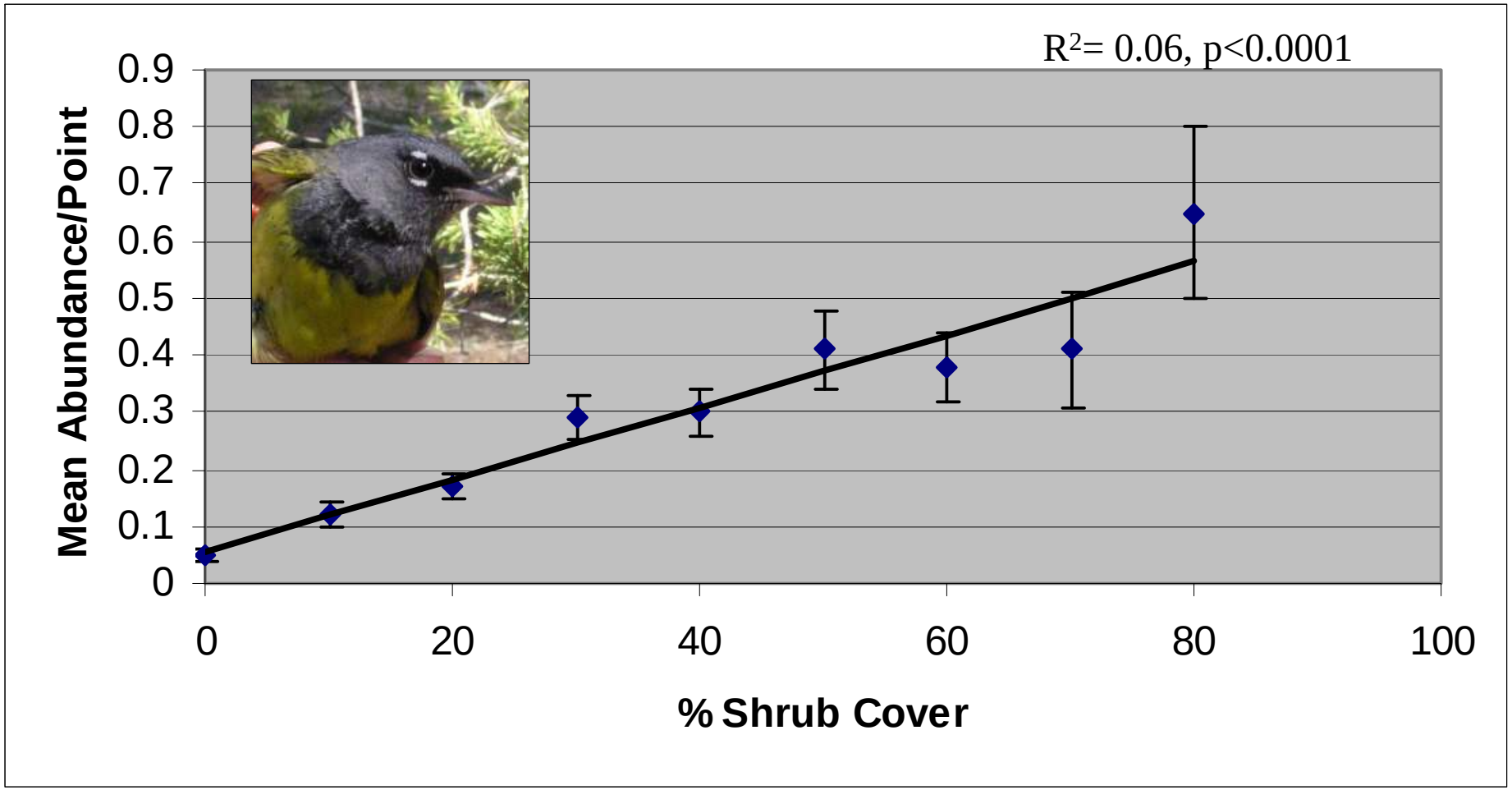
MacGillivray's Warbler and Shrub Cover in the PLAS



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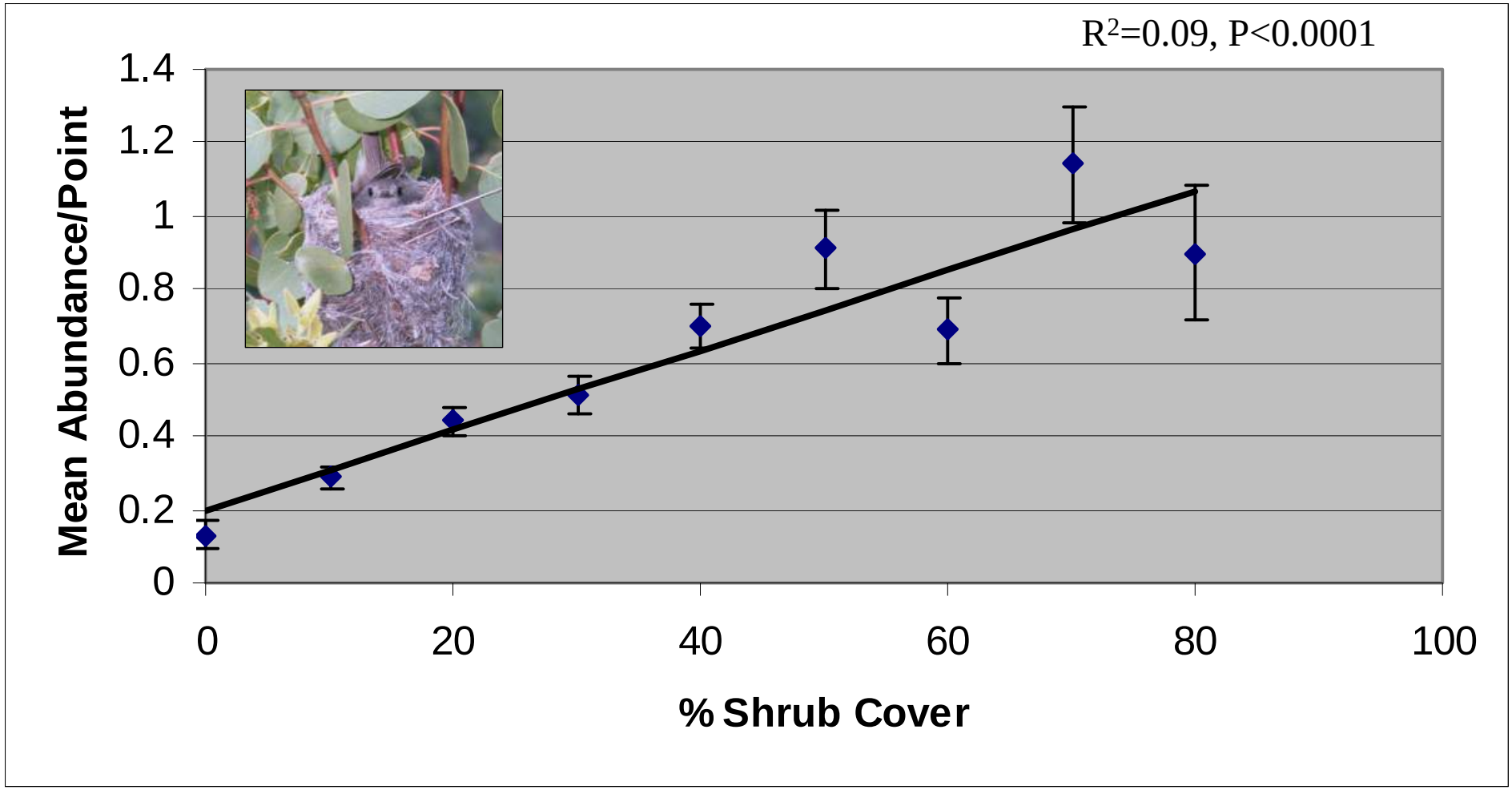
Dusky Flycatcher and Shrub Cover in the PLAS



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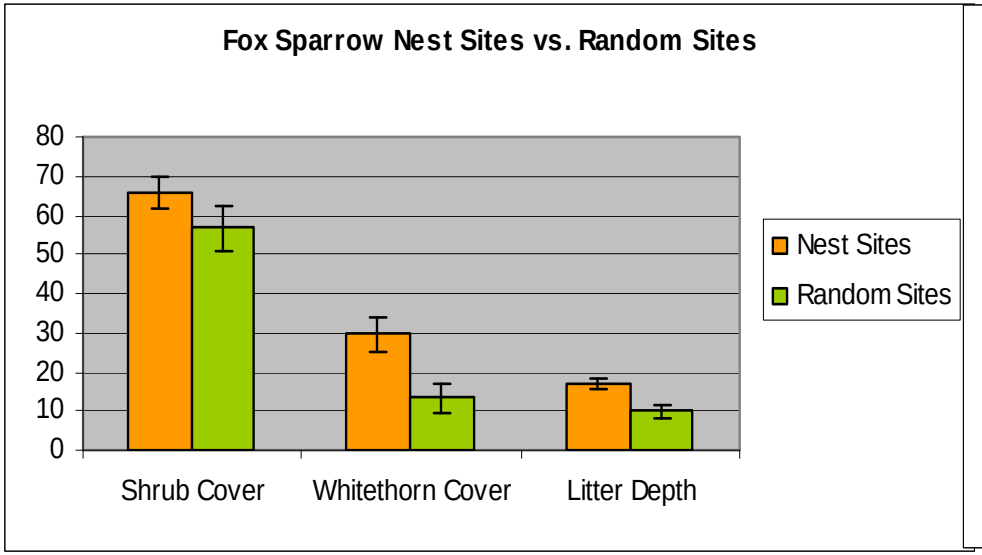
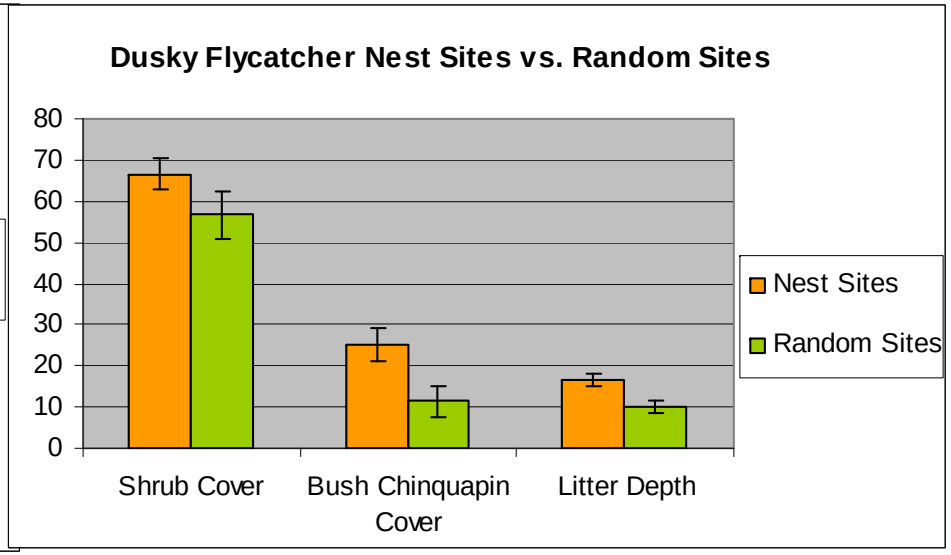
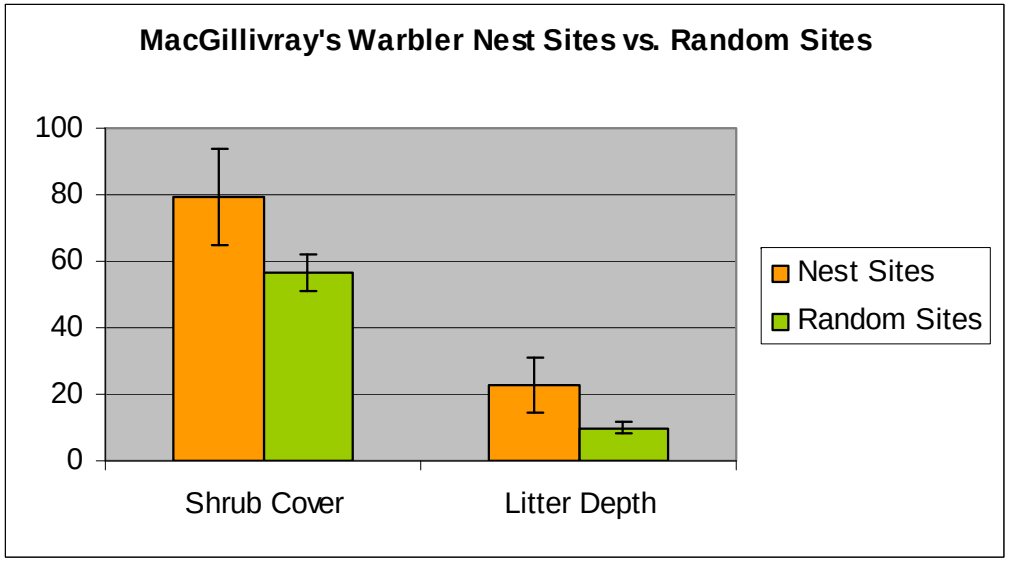
Shrub Bird Species Nesting Habitat







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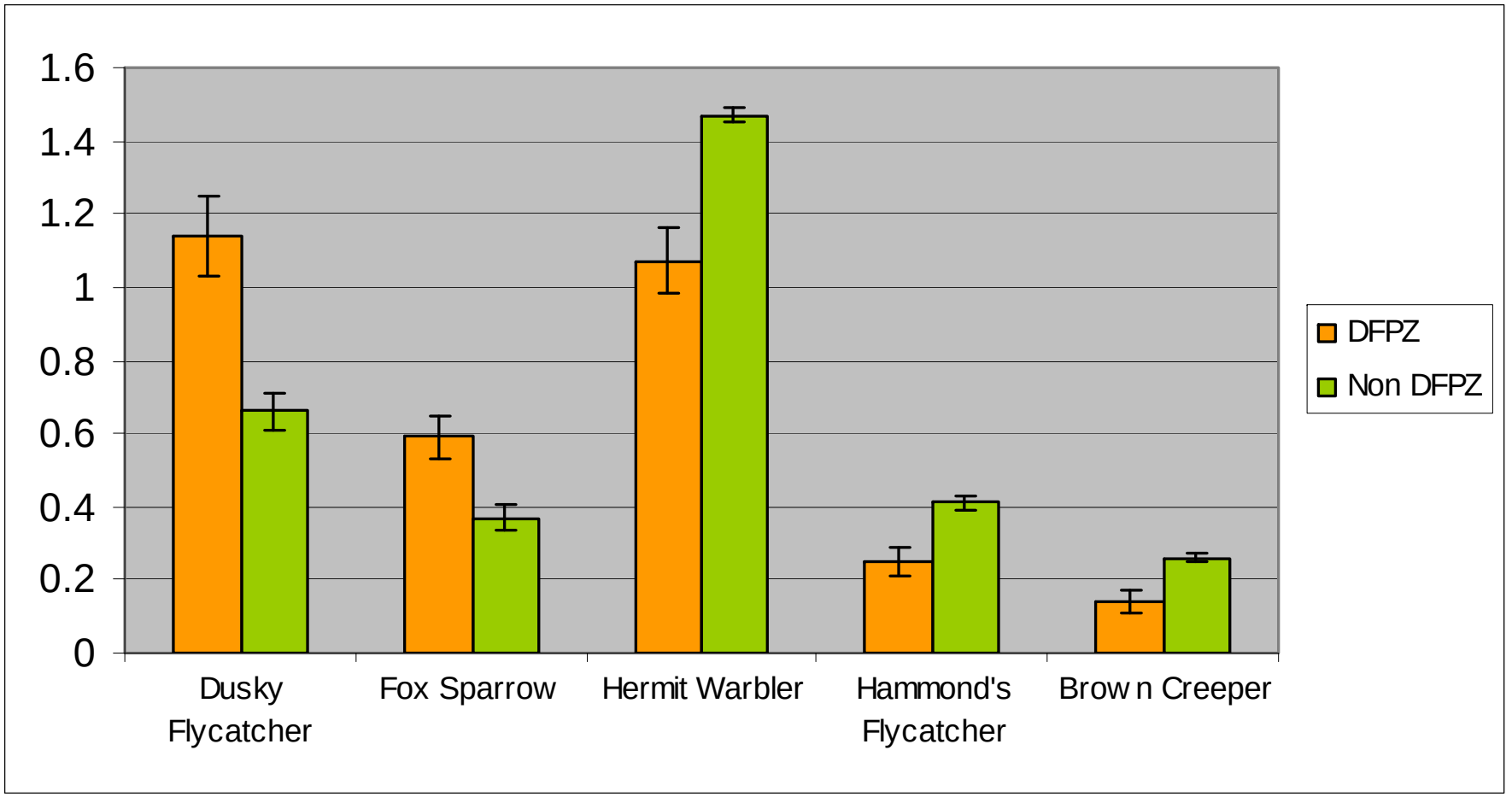
Species Abundance at Proposed DFPZ's



Open Forest and Shrub Limiting Factors

- Shrub and other open forest habitats are likely to decline under current management (both HFQLG and SNFPA).

  - Fire suppression

  -50% of forest is on “closed canopy trajectory”

  -Fuel reduction treatments retain 40 – 60% canopy cover

  -Many fuels projects target shrub areas for mastication

Managing Shrub habitat for Birds

- Re-evaluate shrub importance vs. fire risk
- Group selects need to be larger (less quantity?)
- Reduce stocking rates of replanted areas
- Regenerate mixed species shrub habitats
- Leave snags and a few large trees.
- Use fire to achieve shrub regeneration
- Fuel treatments and Area thinning - use mosaic design
- Post-fire Management (salvage, dense replantings, shrub removal).

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Aspen

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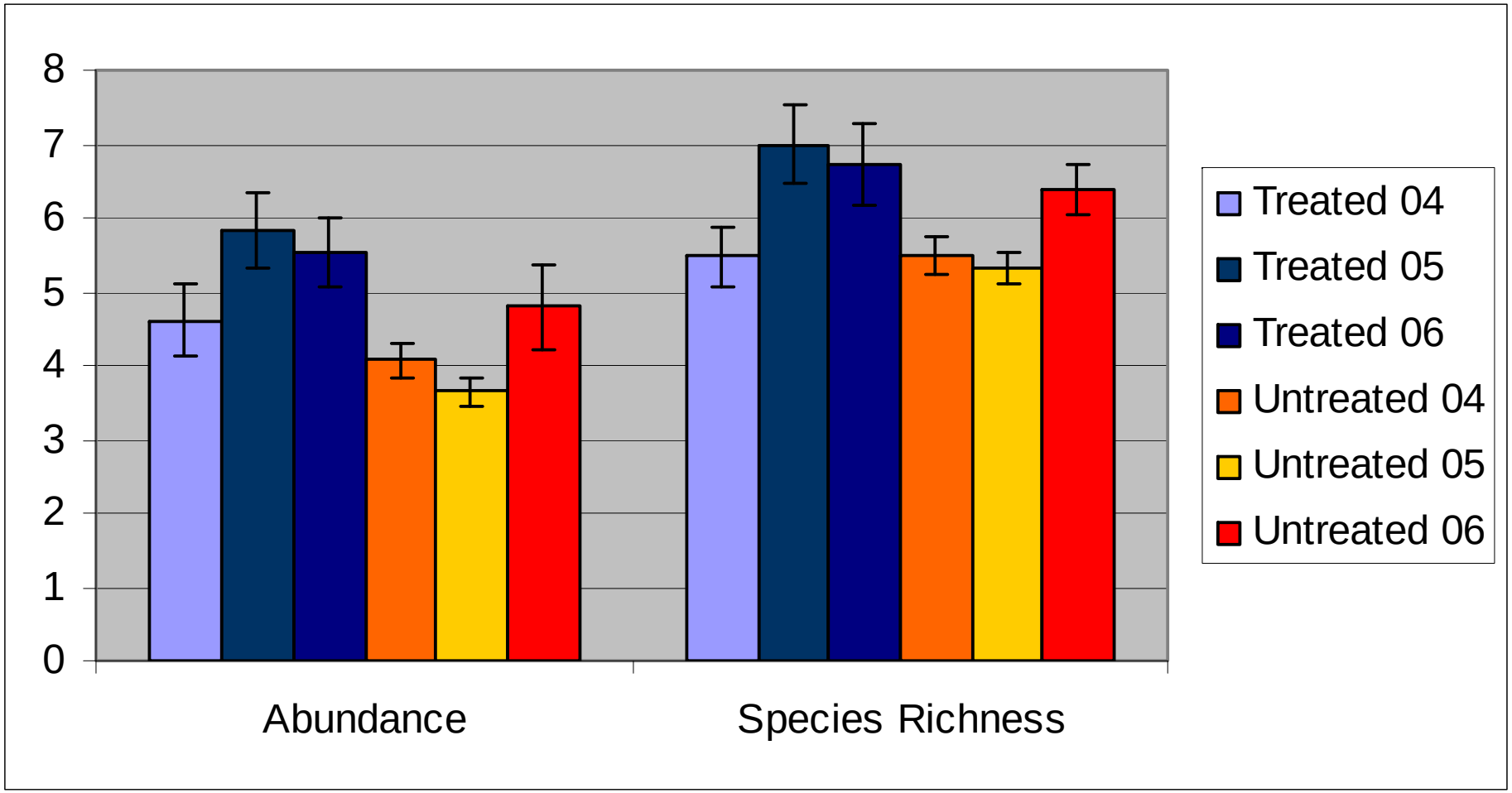
Treated vs. Untreated Aspen



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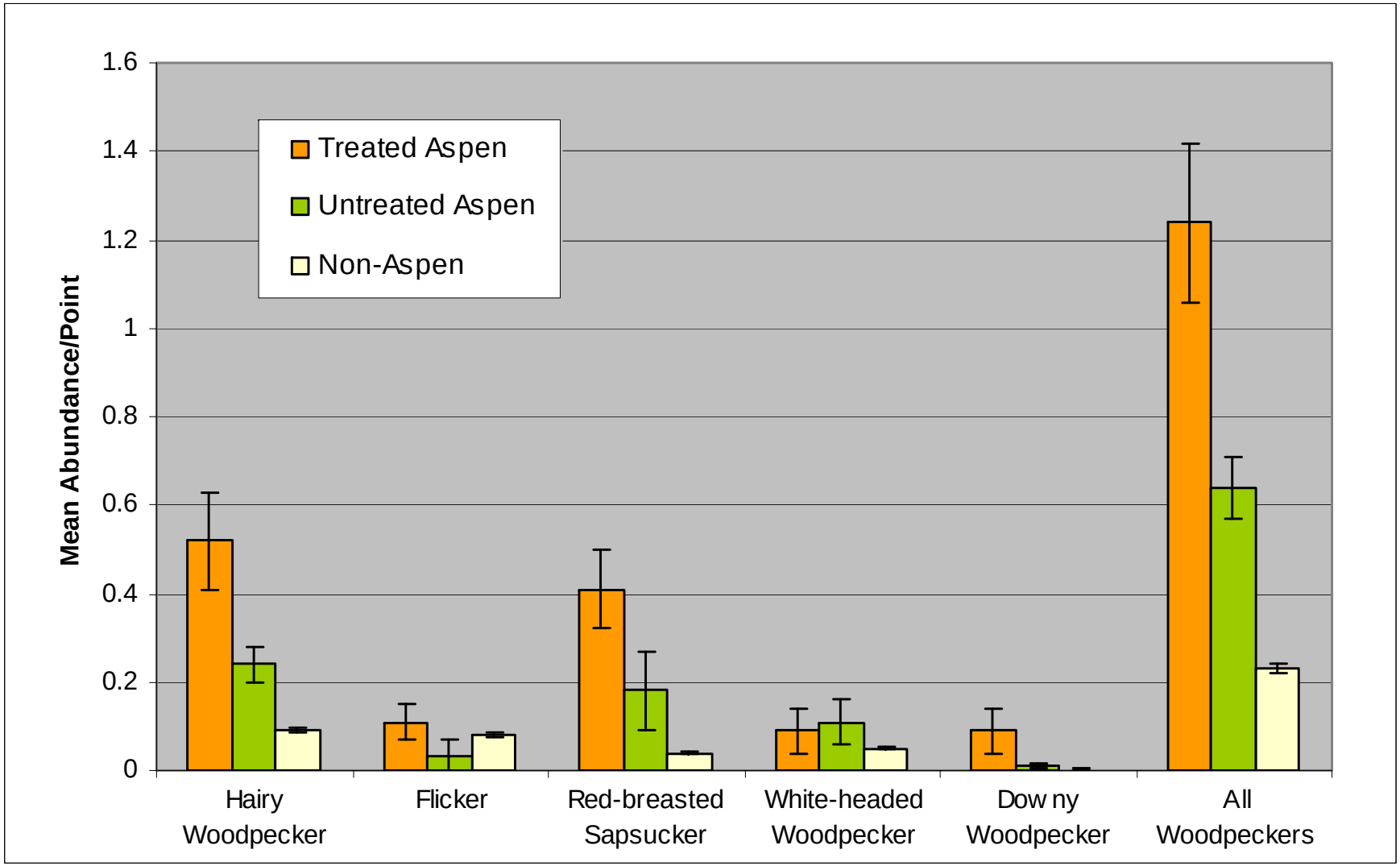
Woodpeckers & Aspen



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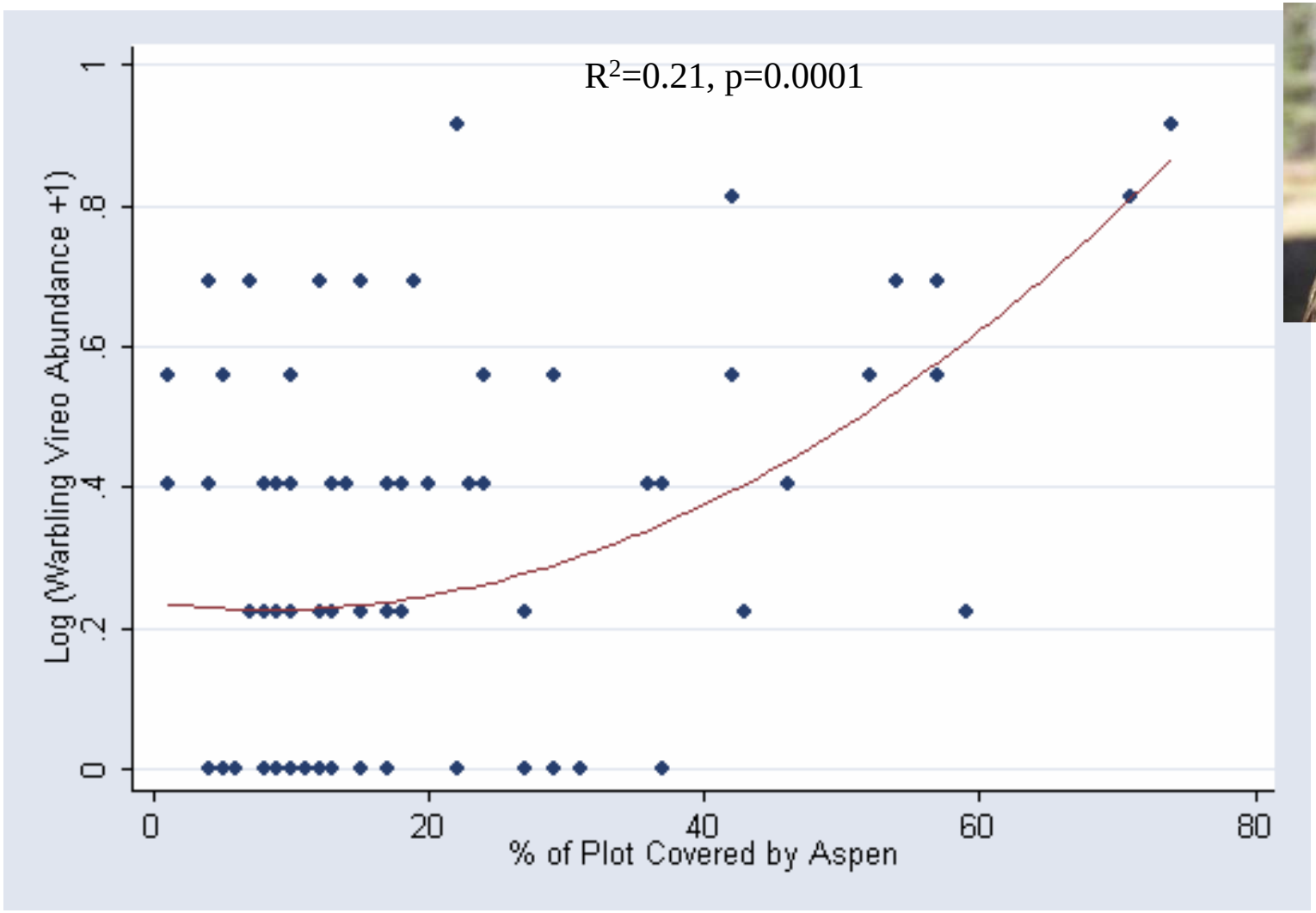
Warbling Vireo and Aspen Cover



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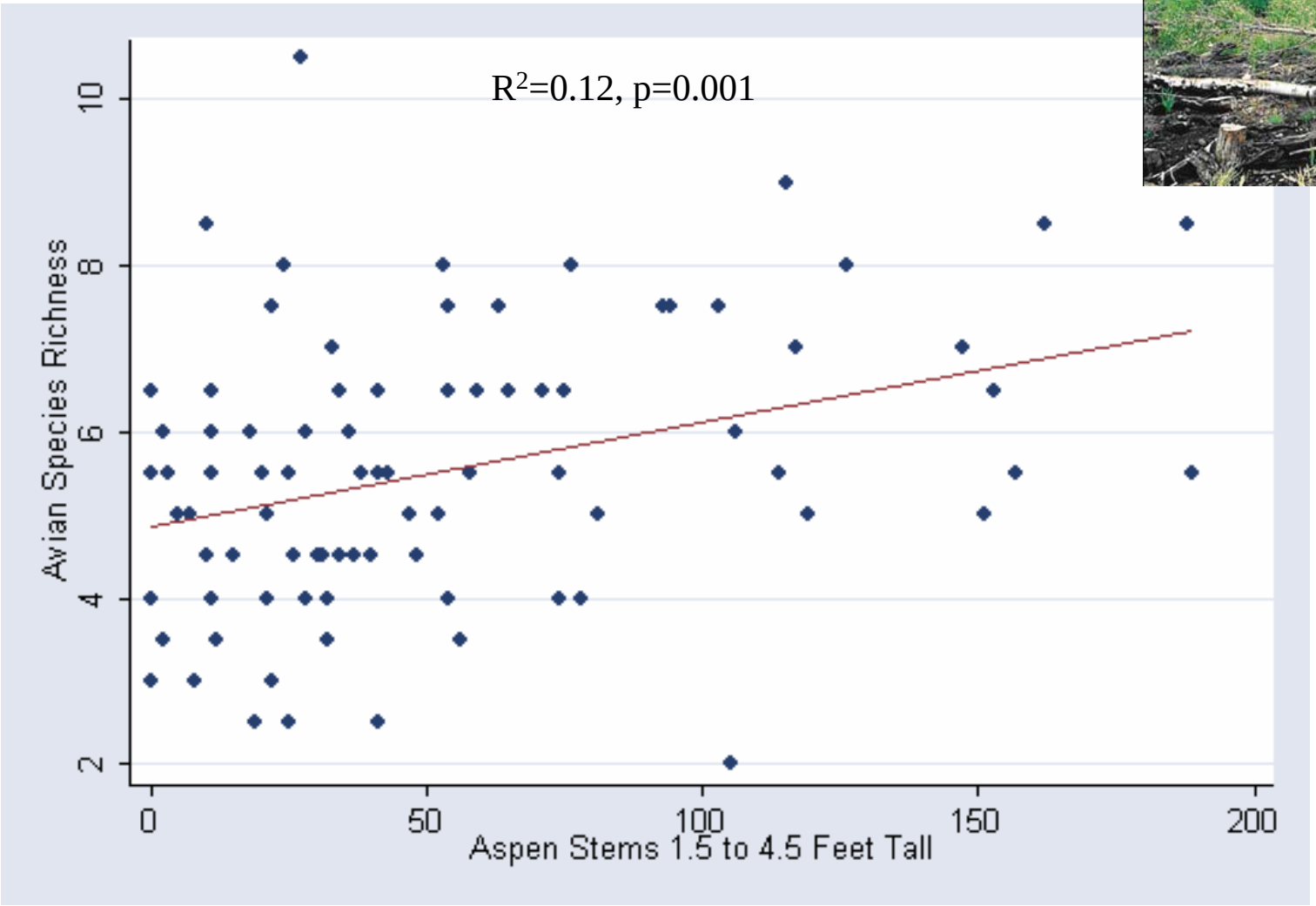
Importance of Understory Aspen



Managing Aspen for Birds

- Aspen treatments are warranted
- Birds respond immediately to treatment – especially woodpeckers, mountain bluebird, tree swallow
- Manage for aspen cover over 40% for Warbling Vireo
- Manage for a range of aspen successional stages including early seral aspen with dense regeneration.

Local versus Landscape Effects

Birds respond to:

- "Local" features (e.g. vegetation composition)
- "Landscape" composition features

Howell et al 2000

Renjifo 1999

Landscape Ecology Metrics

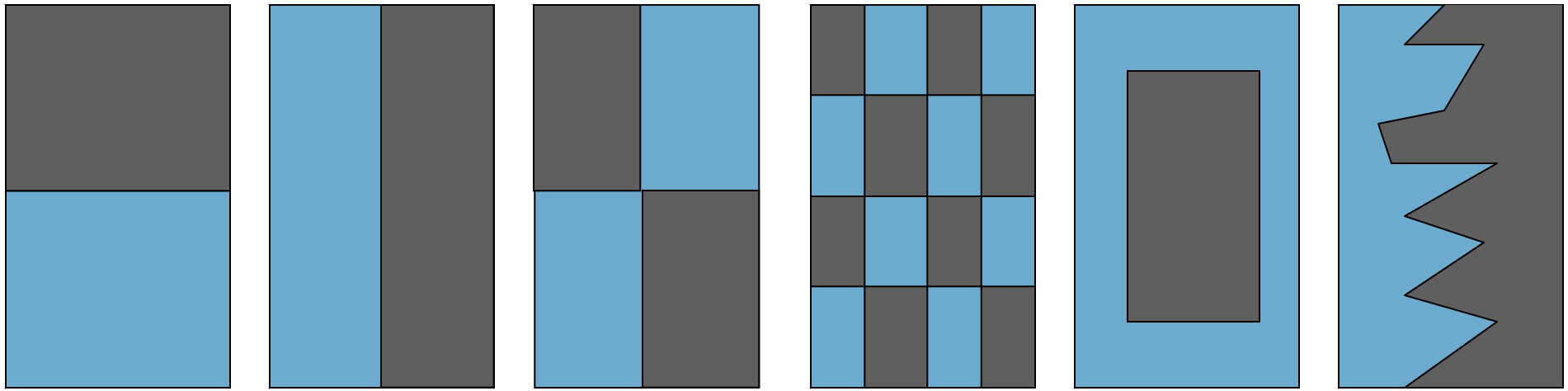
- Different configurations can have very different effects on ecological function.

Interspersion and Juxtaposition Index (IJI) – measure of how dispersed individual habitat patches are in relation to patches of other habitat types.

Shannon Habitat Diversity Index (Diversity) – Diversity of habitat types

Contagion – index of the amount of habitat clumping.

Core Area – measure of the amount of the area away from edge.



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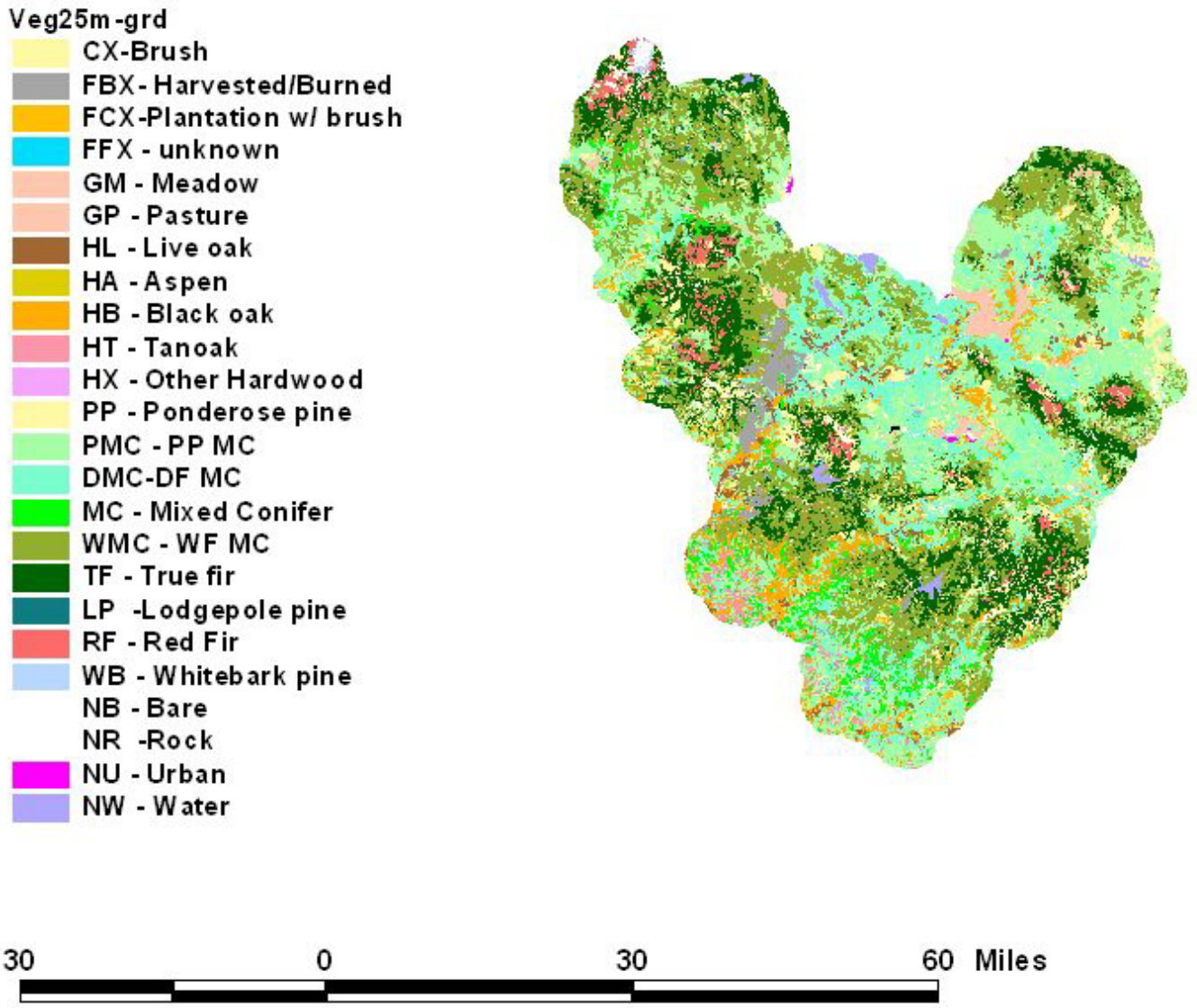
Original Vegetation Map



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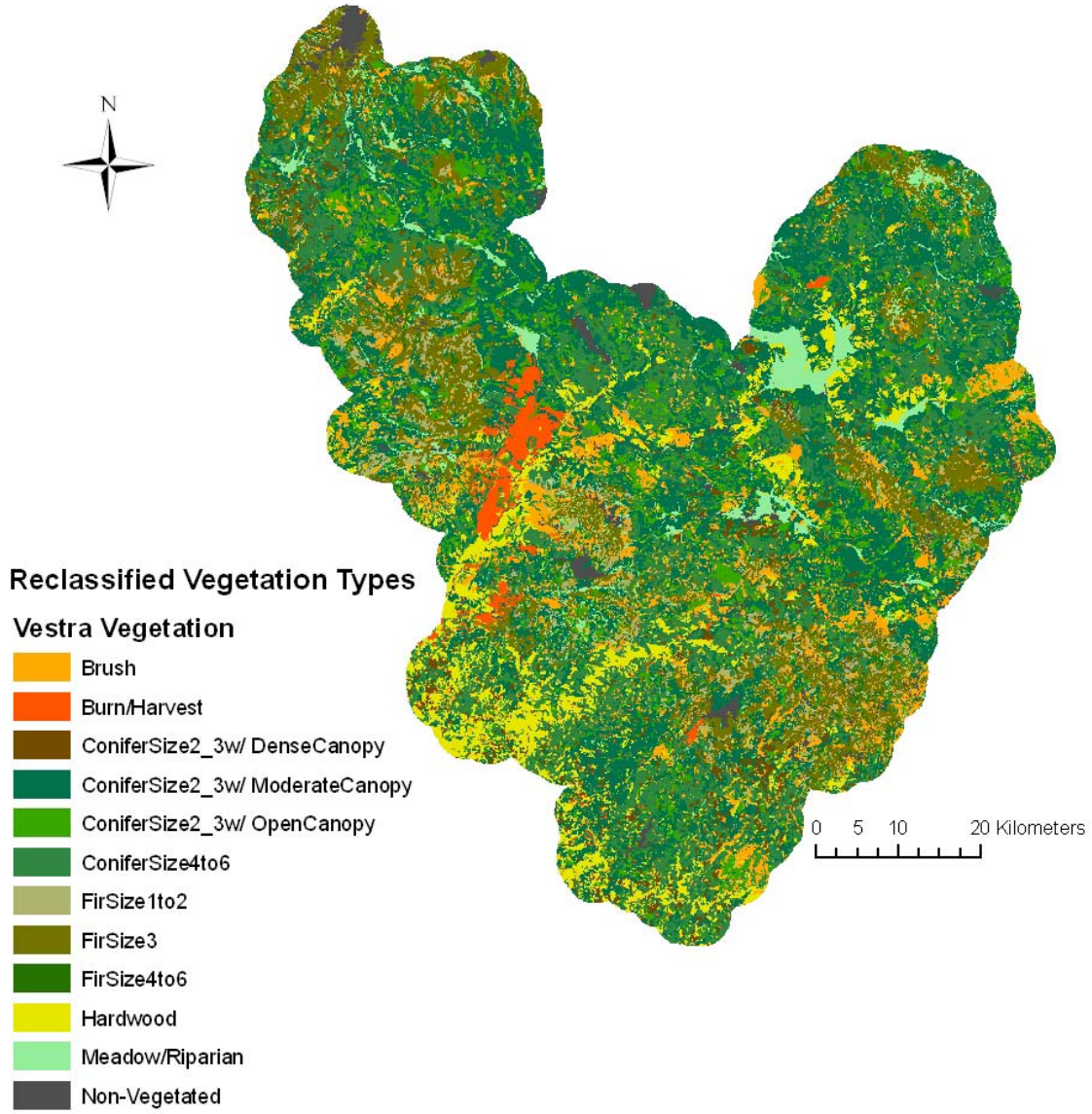
Reclassified Vegetation Map



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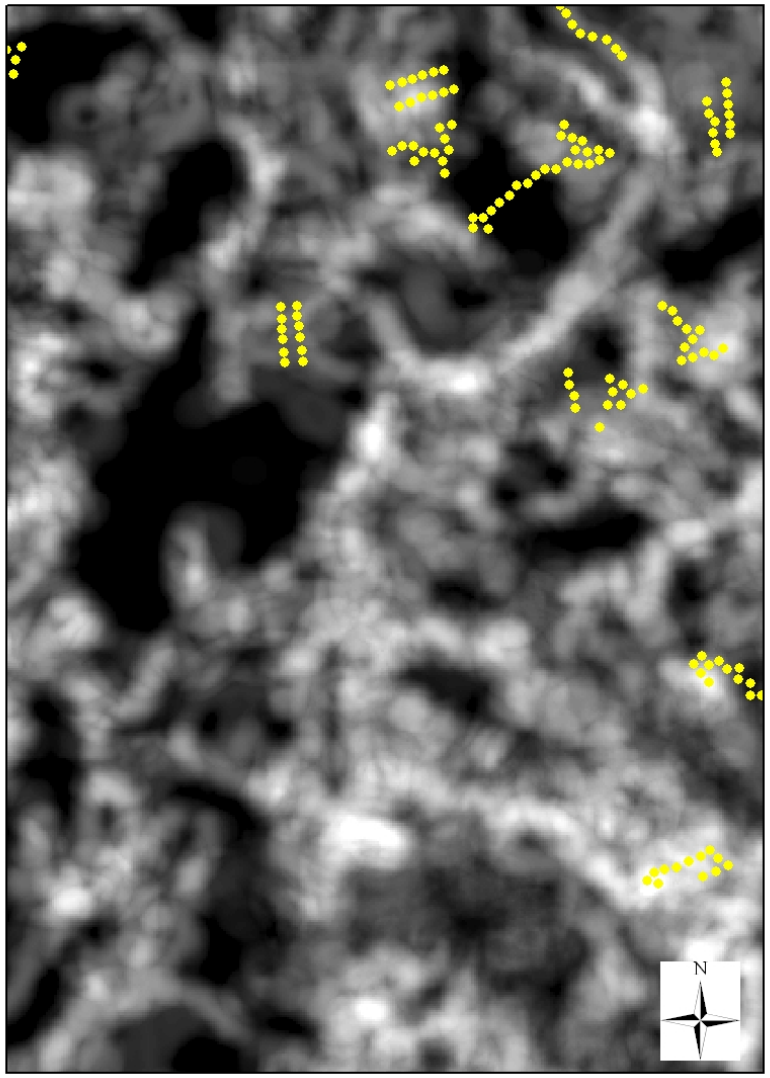
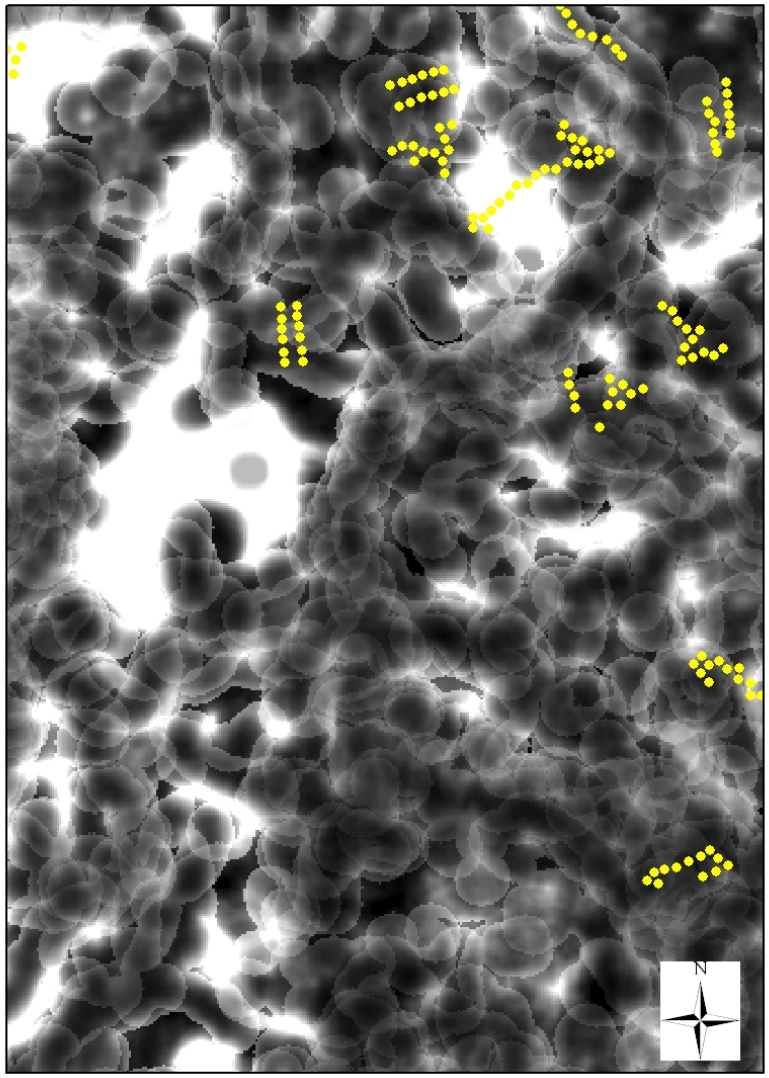
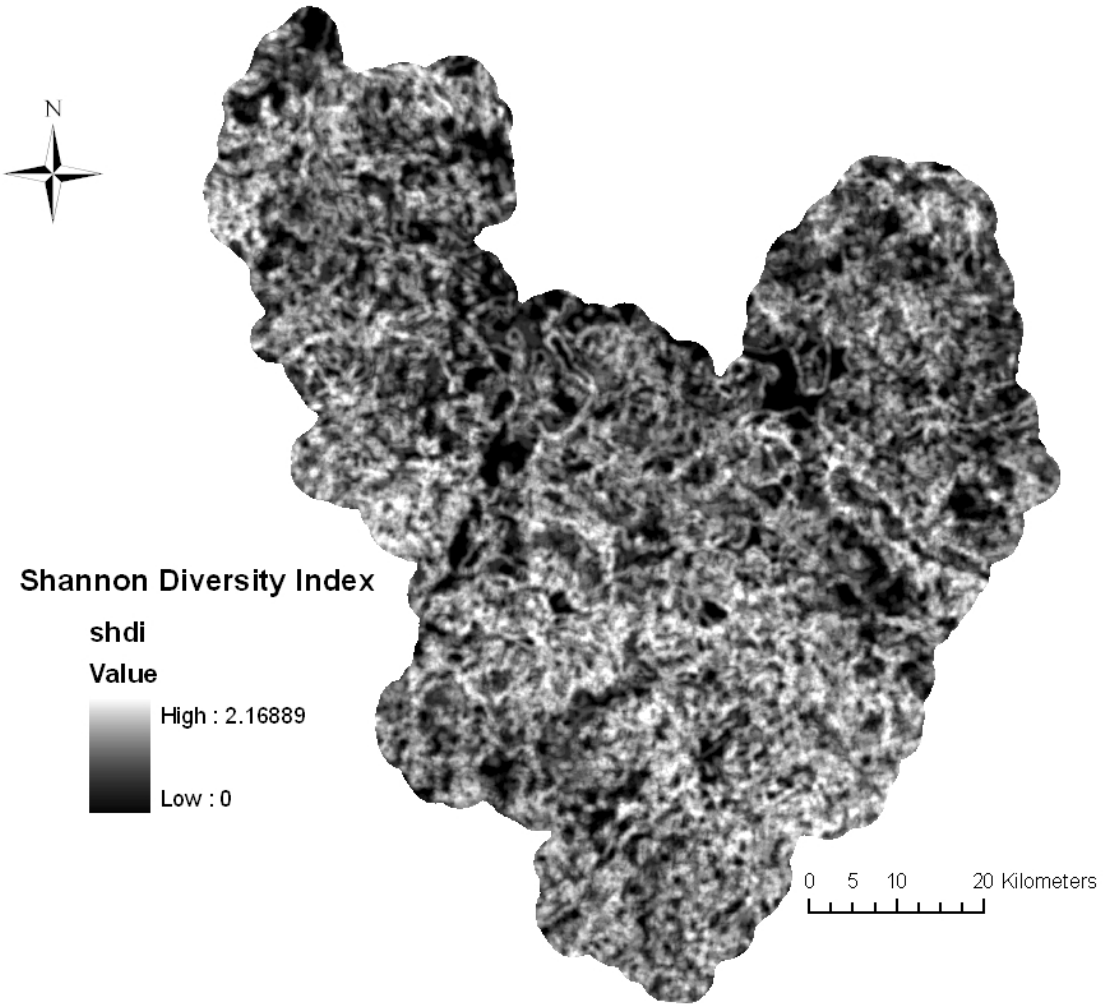
Shannon Diversity Index



Contagion Index




N
Shannon Diversity Index
shdi
Value
High : 2.16889
Low : 0
0 5 10 20 Kilometers

Olive-sided Flycatcher

Obs Model	ΔAicc	w_Akaike
Diversity	**0.0000**	**0.49085**
Diversity + Local Veg	**0.6698**	**0.35115**
All Landscape + Local Veg	2.2988	0.15552
IJI + Local Veg	10.5702	0.00249
Core Area	27.6402	0.00000
Core Area + Local Veg	29.1555	0.00000
All Landscape Variables	0.4896	0.00000
IJI	37.3754	0.00000
Null	47.8319	0.00000
Local Veg Only	47.8319	0.00000

OSFL Parameter Estimates-Model averaged

Parameter	Est. Model Average	SE
Contagion	0.0037	0.00755
IJI	**0.1116**	**0.00340**
Intercept	-3.6321	1.12320
Diversity	0.6576	0.57699
Core Area	-0.0214	0.02363
Maximum Tree DBH	0.0033	0.00295
Snags >30 inch DBH	**0.0182**	**0.00649**
Total Basal Area	**-0.0810**	**0.01812**

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Hermit Warbler

Model	Δaicc	w_Akaike
Diversity + Local Veg	**0.000**	**0.91338**
All Landscape + Local Veg	5.121	0.07058
Core Area + Local Veg	8.137	0.01562
IJI + Local Veg	15.411	0.00041
Local Veg only	33.505	0.00000
All Landscape no local	367.290	0.00000
Core Area	367.886	0.00000
Diversity	368.265	0.00000
IJI	384.266	0.00000
Null	439.716	0.00000

Hermit Warbler Parameter Estimates-Model Averaged

Parameter	Est. Model Average	SE
Contagion	-0.0002	0.00044
IJI	-0.0001	0.00017
Intercept	-1.4229	0.15779
Diversity	-0.3535	0.07038
Core Area	0.0004	0.00089
Mixed Conifer Index	0.0245	0.00553
Canopy Height	0.0260	0.00272
Total Basal Area	0.0072	0.00371
Tree Cover	0.0109	0.00108
Tree Richness	0.0905	0.01591

Local vs. Landscape Summary

- For almost all species landscape factors are important
- Manage beyond the patch, consider habitat heterogeneity and configuration – both pro and con.

Integration Tools

Interactive GIS

New predictive modeling tools

White Papers

Posters, presentations, field trips, and publications

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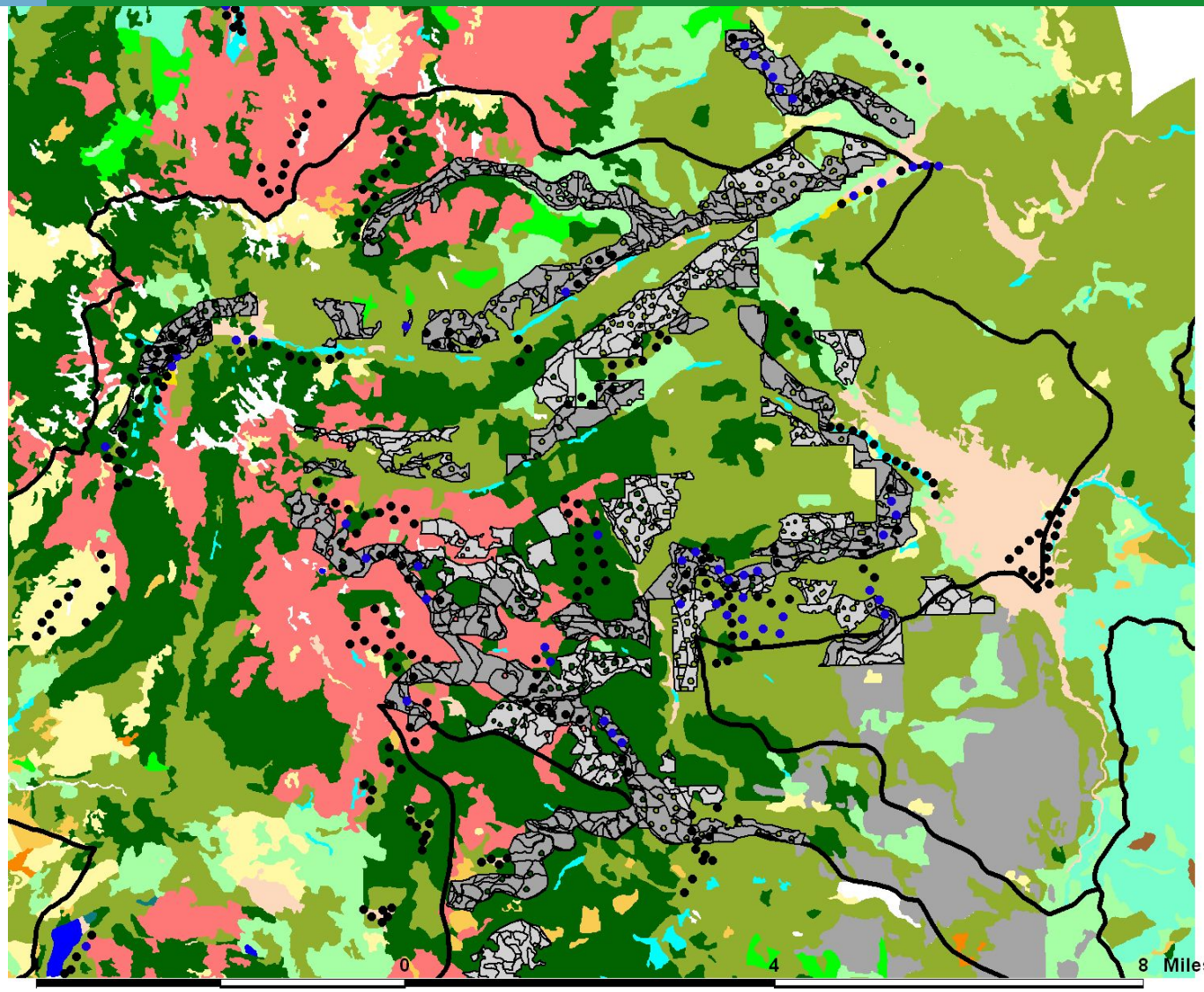
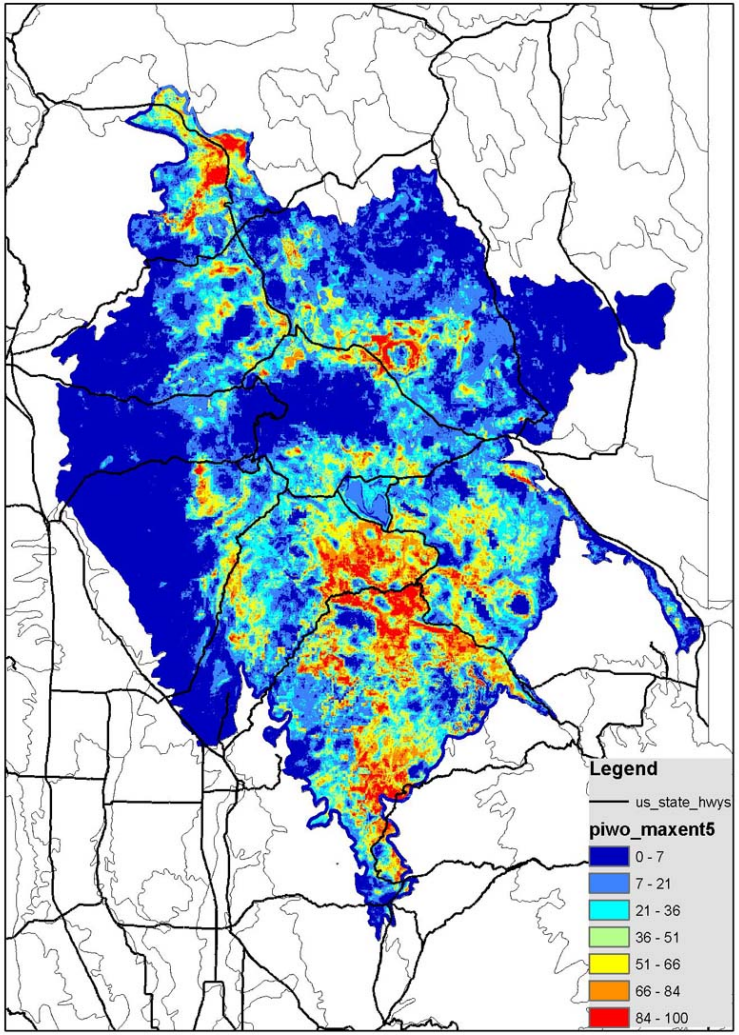
MIS Interactive GIS Tool – Pileated Woodpecker



MIS Predictive Models – Pileated Woodpecker

- Focus sampling areas
- Prioritize areas to manage for these species



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White Papers

Managing Shrub Habitats for Birds in the Sierra Nevada

Shrub-dominated habitats are a vital component of Sierra forests for numerous bird species. Over 20% of landbirds breeding in the Sierra Nevada nest in shrub habitat. These shrub communities appear at risk for several reasons. First, the role of fire has been and continues to be reduced in shaping the Sierra ecosystem. Second, forest management has moved away from practices that create early successional habitat in favor of ones that emphasize late seral closed canopy forests. Finally, in many areas shrubs have been targeted for elimination under fuels reduction projects - with mastication and even herbicide treatments being implemented. The cumulative effects of all of these management decisions, raise concern that open forest habitats that support a shrub understory and early successional shrub fields will decrease in quantity and quality in the Sierra Nevada and with them shrub-dependent birds and other wildlife.

Key Shrub Bird Species

Mountain Quail
Calliope Hummingbird
Dusky Flycatcher
Olive-sided Flycatcher
Yellow Warbler
MacGillivray's Warbler
Green-tailed Towhee
Fox Sparrow
White-crowned Sparrow

Strategies for Managing Shrub Habitat for Birds

With current management direction focused on increasing canopy cover and reducing fire hazards, shrub habitat is at risk. The needs of shrub-dependent birds can be met by incorporating the following recommendations into project planning and other management activities:

1. **Value Shrubs as important wildlife habitat.** All management activities that may impact shrub habitats should consider the ecological value of this habitat to wildlife.
2. **Manage group selects and post-fire for shrubs.** Timber harvest or fires that significantly reduce canopy in areas >5 acres can provide high quality habitat for shrub-dependent birds. Herbicide, mastication, and conifer release treatments that inhibit natural shrub regeneration eliminate important bird habitat.
3. **Prioritize mixed shrub habitats over monotypic stands** Mixed species shrub fields support greater diversity and densities of shrub-nesting birds than manzanita-dominated sites.
4. **Increase use of prescribed fire.** Fire can help regenerate senescing shrubs, reduce surface fuels that inhibit shrub recruitment, and thin encroaching conifers.

Mountain Quail

Key Habitat Features

Shrub Diversity
>50% Shrub Cover
>5 acre patch size
Large Snags & remnant trees
Leaf Litter

Dusky Flycatcher on nest

Managing Mixed Conifer-Hardwood Habitat for Birds in the Sierra Nevada

Mixed-conifer hardwood (MCH) is among the most avian species-rich forest habitats in the Sierra Nevada, and supports the greatest number of neotropical migrants. Several bird species are strongly associated with hardwoods - especially black oak. The high structural complexity and floristic diversity typical of healthy MCH habitat is thought to be a primary driver of avian diversity. Additionally, the acorns produced by oaks provide a unique and important resource for an array of wildlife species. In the absence of fire, these habitats have become less complex and diverse, with pines and hardwoods being replaced by dense stands of fir and cedar. In the absence of natural disturbance regimes, management intervention appears necessary; if taken in the form of strategically designed thinning and prescribed fire it can mimic natural processes and restore the important habitat components and ecological processes that support the full range of MCH associated bird species.

Key MCH Bird Species

Flammulated Owl
Band-tailed Pigeon
Acorn Woodpecker
White-headed Woodpecker
Cassin's Vireo
Warbling Vireo
Nashville Warbler
Black-throated Gray Warbler
MacGillivray's Warbler
Western Tanager

Managing MCH Habitat for Birds

With the apparent degradation of hardwoods and other open-forest habitat features within mixed conifer forests in the Sierra, restoration treatments are necessary. Improving the health and viability of hardwoods while improving the habitat value to the MCH bird community is possible. In order to maximize the benefit to breeding birds managers should consider the following:

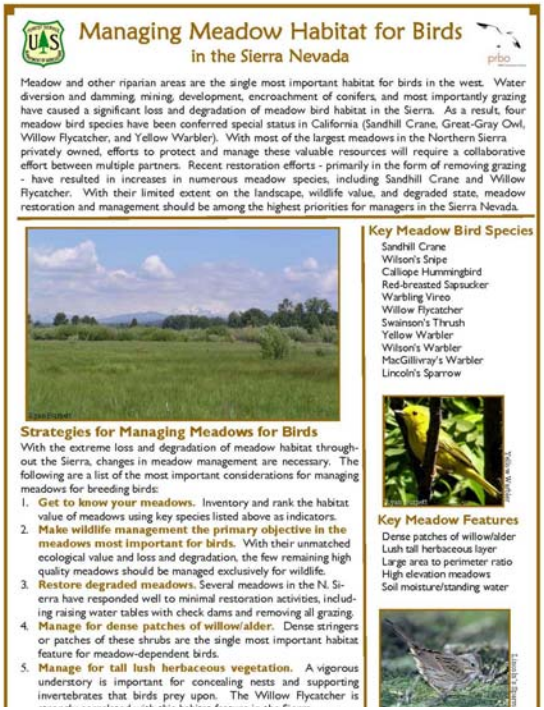
1. **Reduce conifer cover to enhance hardwoods.** This is the most important consideration necessary to avoid further reduction in hardwoods and overall degradation of this important bird habitat.
2. **Manage for cavities.** Both snags and decay in living hardwoods are critical sources of cavities. 30% of the breeding landbirds in MCH habitat in the Northern Sierra nest in cavities.
3. **Manage for structural diversity.** Under and middle-story foliage volume are positively correlated with avian richness in MCH habitat in the Sierra Nevada.
4. **Manage for dense and diverse understory.** Many avian species forage or conceal their nests in the understory and on the ground in MCH habitat (e.g., Nashville Warbler, Fox Sparrow).
5. **Manage with Fire.** Fire was a critical part of the natural cycle that maintained hardwoods, snags, and understory plants in MCH.

Nashville Warbler

Key Habitat Features

Structural diversity
Understory foliage volume
Oak regeneration
Mast production
Tree species diversity

Western Tanager



Managing Meadow Habitat for Birds in the Sierra Nevada

Meadow and other riparian areas are the single most important habitat for birds in the west. Water diversion and damming, mining, development, encroachment of conifers, and most importantly grazing have caused a significant loss and degradation of meadow bird habitat in the Sierra. As a result, four meadow bird species have been conferred special status in California (Sandhill Crane, Great-Gray Owl, Willow Flycatcher, and Yellow Warbler). With most of the largest meadows in the Northern Sierra privately owned, efforts to protect and manage these valuable resources will require a collaborative effort between multiple partners. Recent restoration efforts - primarily in the form of removing grazing - have resulted in increases in numerous meadow species, including Sandhill Crane and Willow Flycatcher. With their limited extent on the landscape, wildlife value, and degraded state, meadow restoration and management should be among the highest priorities for managers in the Sierra Nevada.

Key Meadow Bird Species

Sandhill Crane
Wilson's Snipe
Calliope Hummingbird
Red-breasted Sapsucker
Warbling Vireo
Willow Flycatcher
Swainson's Thrush
Yellow Warbler
Wilson's Warbler
MacGillivray's Warbler
Lincoln's Sparrow

Strategies for Managing Meadows for Birds

With the extreme loss and degradation of meadow habitat throughout the Sierra, changes in meadow management are necessary. The following are a list of the most important considerations for managing meadows for breeding birds:

1. **Get to know your meadows.** Inventory and rank the habitat value of meadows using key species listed above as indicators.
2. **Make wildlife management the primary objective in the meadows most important for birds.** With their unmatched ecological value and loss and degradation, the few remaining high quality meadows should be managed exclusively for wildlife.
3. **Restore degraded meadows.** Several meadows in the N. Sierra have responded well to minimal restoration activities, including raising water tables with check dams and removing all grazing.
4. **Manage for dense patches of willow/alder.** Dense stringers or patches of these shrubs are the single most important habitat feature for meadow-dependent birds.
5. **Manage for tall lush herbaceous vegetation.** A vigorous understory is important for concealing nests and supporting invertebrates that birds prey upon. The Willow Flycatcher is

Yellow Warbler

Key Meadow Features

Dense patches of willow/alder
Lush tall herbaceous layer
Large area to perimeter ratio
High elevation meadows
Soil moisture/standing water

Managing Aspen Habitat for Birds in the Sierra Nevada

Aspen are often out-competed by conifers in the Sierra Nevada, due to extensive livestock grazing and the absence of regular fire. As a result, the health of aspen has deteriorated and estimates suggest its extent in western North America has been reduced by as much as 96%. Aspen habitat, especially when associated with riparian vegetation, is the single most species-rich avian habitat in the Sierra Nevada. Several bird species of management interest are associated with aspen including Northern Goshawk, Red-breasted Sapsucker, Warbling Vireo, and Mountain Bluebird. With its disproportionate importance to birds and other wildlife, limited extent on the landscape, and significant loss and degradation, aspen restoration should be among the highest priorities of land managers in the Sierra Nevada.

Key Aspen Bird Species

Northern Goshawk
Red-breasted Sapsucker
Warbling Vireo
Western Wood-Pewee
Dusky Flycatcher
Tree Swallow
Mountain Bluebird
Swainson's Thrush
Chipping Sparrow

Strategies for Enhancing Aspen Bird Habitat

With the extensive loss and degradation of aspen throughout the Sierra, large-scale restoration efforts are called for to avoid further losses and increase the ecological value of this vital habitat. The following are a list of the most important considerations for managing aspen for breeding birds:

1. **Promote aspen regeneration and expansion.** This is the single most important management consideration to avoid further losses and degradation of this important habitat.
2. **Manage for multiple age and cover classes.** Smallest size classes of aspen are important predictors of avian richness.
3. **Restore riparian aspen communities.** When healthy, this is the single most species-rich habitat in the Sierra, supporting numerous birds species of management concern.
4. **Manage for dense and diverse understory.** Understory aspen and riparian shrubs are important for numerous avian species.
5. **Limit grazing and over-browsing** Grazing and over-browsing can significantly reduce aspen regeneration, understory foliage volume, and the structural diversity important for numerous bird species. Grazing may also increase cowbird abundance which can negatively impact breeding birds.

Mountain Bluebird

Key Habitat Features

Structural diversity
Dense herbaceous layer
Decay in Live stems
Cavities
Multiple size classes
Riparian shrub understory

Tree Swallow exiting aspen nest cavity

Oak Symposium Poster – LNF and PRBO

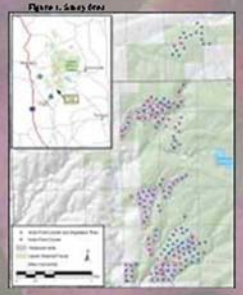
Pine-Oak Habitat Enhancement on the Lassen National Forest

Mark R. Williams[1], Coye Robbins[1], and Ryan Burnett[2]
[1]USDA Lassen National Forest, [2]PRBO Conservation Science

BACKGROUND AND INTRODUCTION

The composition and structure of western North American forests have been altered by a number of factors including fire suppression, timber harvest, and perhaps climate change. In the Sierra Nevada Mountains of California, these factors have tipped the competitive balance in favor of shade tolerant conifers, predominantly white fir, over shade intolerant pines and hardwoods (Vankat and Major 1978, Parsons and Benedetti 1979, Minnich et al. 1995). California black oak, a shade intolerant species, is particularly susceptible to encroachment of conifers. The lack of natural disturbance regimes, such as fire, have adversely affected the health, extent of the pine and black oak components of mixed conifer hardwood (MCH) communities. Without some management intervention, conifer oak woodlands appear to be at risk in many areas, which in turn may affect long-term viability. In 2005, a pilot project was implemented to increase the health and curb the decline of pine, black oak, and other hardwoods and enhance the value of habitat for wildlife on approximately 1000 acres of MCH habitat in the Almanor Ranger District of the Lassen National Forest. Vegetation and avian monitoring are key components of the project with results being adapted into projects currently being planned.

PROJECT SUMMARY



Overview

- Mixed conifer fir dominated habitat with variable amounts of oak & shrub.
- 880 acres mechanical & 120 hand treatment
- Timber sale harvest – 2005-2007

Objectives

- Improve growing conditions for oak
- Increase oak DBH and canopy density
- Reduce white fir dominance in canopy and understory
- Increase habitat value for wildlife
- Reduce fuels to allow for underburning
- Generate revenue through timber receipts to fund underburning and other management objectives.

Prescription

Variable basal area retention based on extent of oak:
More oak - basal area reduced to ~ 125 ft²
Less oak - basal area reduced to ~ 150 ft²

- Prioritize ponderosa and sugar pine retention and white fir reduction
- Reduce the number of stems in multi-stemmed oaks
- Underburn to stimulate understory regeneration and oak vigor

Pre-treatment (2004)

Post-Treatment (2006)

VEGETATION MONITORING

Introduction

Vegetation monitoring was implemented in 2004 & 2005 to measure pre-treatment conditions in the project area. We are currently measuring initial post-treatment conditions and will continue to monitor response of various aspects of the MCH plant community.

Objectives

Monitor the effects of conifer thinning and prescribed burning treatments on:

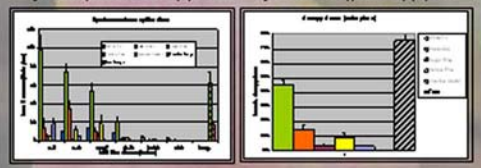
- Forest structure and tree species composition
- Understory herbaceous and shrub communities
- California black oak regeneration and productivity

Methods

- 68 stratified random plots (Figure 1 & 2).
- ¼ acre tree density/composition plot
- 3m seedling & 1m herbaceous plots
- 16m canopy and shrub cover transects

Pre-treatment Results

- Mean canopy cover is 75%
  - White fir - 45%,
  - Black oak - 15%
  - Sugar and Ponderosa Pine - 12%
- White fir is significantly more abundant in each DBH size class



AVIAN MONITORING

Introduction

MCH forest is one of the most avian rich habitats in the Sierra Nevada, including a relatively large number of neotropical migrants. Thus, mixed-conifer hardwood is a key habitat in the Sierra Nevada for the conservation and management of birds.

Objectives

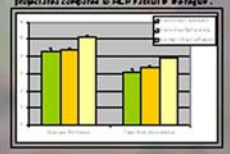
- Identify key habitat attributes that influence avian community
- Determine response to treatments of avian species richness, total bird abundance, and abundance of focal species.

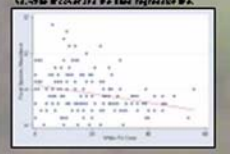
Methods

- 5 minute point counts w/ relevé vegetation surveys (Ralph et al. 1993).
- 149 stations-73 in treatment stands & 76 in reference stands (Figure 1).
- Identified suite of focal species (Burnett *in press*).

Pre-treatment Results

- Mean per point species richness and total bird abundance are lower in project area than other MCH habitats in the region (Figure 5).
- Significant predictors ($p<.05$) of focal species richness and/or abundance:
  shrub cover (positive)
  # of black oaks <6 inch DBH (positive)
  white fir Cover (negative; figure 6)





Discussion

The pre-treatment vegetation and avian monitoring results completed to date support the original project assumptions and highlight the need for treatment to meet the ecological objectives of a healthy mixed conifer/oak woodland community. The project area is in a climax state where white fir is significantly more numerous than any other tree species and dominates both the total canopy cover and all size classes of trees. Shrub cover, structural diversity, and oaks – important avian habitat components – appear to be limited by white fir encroachment. We plan to continue a long-term monitoring program at these sites in order to assess if objectives are being met. Monitoring will also help us to glean important information which will guide future MCH enhancement projects. A substantial number of black oak and pine communities still occur on the Almanor Ranger District. However, with continued canopy closure and fir encroachment, MCH communities will continue to decline and adversely impact a suite of wildlife species that depend on this important habitat.

Conclusions

- Are you still with me?
- Ecosystem approach to management is necessary to meet the competing needs of the full compliment of wildlife.
- Birds are ideal candidates for providing some of the necessary feedback.
- Research and management must continue to find ways to integrate more results to ensure informed state of the science management decisions are being made.

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