Wildlife Terrestrial Habitat Question 3 – Geographic Distribution

Goal: Maintain the abundance and distribution of habitats, especially old-growth forests, to sustain viable populations. Also, maintain habitat capability sufficient to produce wildlife populations that support the use of wildlife resources for sport, subsistence, and recreational activities. Maintain ecosystems capable of supporting the full range of native and desired non-native species and ecological processes. Maintain a mix of representative habitats at different spatial and temporal scales (USDA 2008).

Objectives: Provide sufficient habitat to preclude the need for listing species under the Endangered Species Act, or from becoming listed as sensitive due to National Forest habitat conditions. Manage young growth to improve habitat for wildlife and commercial timber products. Include a young-growth management program to maintain, prolong, and/or improve understory forage production and to increase future old-growth characteristics in young-growth timber stands for wildlife (USDA 2008).

Background: The National Forest Management Act requires that the Forest Service provide for the diversity of plants and animals, based upon the suitability and capability of each National Forest, as a part of meeting overall multiple use objectives (16 USC 1604(g)(3)(B)). This direction requires that fish and wildlife habitat be managed to maintain viable populations of existing native and desired non-native vertebrate species. In order to insure that viable populations will be maintained, habitat must be provided to support, at least, a minimum number of reproductive individuals and that habitat must be well distributed so that those individuals can interact with others (36 CFR 219.3).

Due to its historic isolation, ecological complexity, and narrow distribution between the Pacific Ocean and coastal mountain ranges, the North Pacific Coast is considered a hot spot for endemism (Demboski et al. 1999, Cook and MacDonald 2001, Cook et al. 2006). The Endangered Species Act defines endemic as "a species native and confined to a certain region; having comparatively restricted distribution." Southeast Alaska has an especially high degree of endemism in its small mammal fauna, principally because of the combination of its archipelago geography and its highly dynamic glacial history (Demboski et al. 1998). Roughly 23 percent of the mammal taxa in Southeast Alaska (species and subspecies) are endemic to the region. Recent molecular genetic analyses have enabled a more accurate look at the level of genetic divergence among island and the mainland populations than previously possible. These analyses have refuted the classification of some taxa previously believed to be endemic and identified other taxa as endemic (see Dawson et al. 2007 for a current list of species and associated ranges).

Much of our understanding of endemism in southeast Alaska is based on sampling conducted in the 1990s, most of which was conducted by the Museum of Southwestern Biology, University of New Mexico (UNM) and in collaboration with the Tongass National Forest (Cook et al. 2006). A little over 100 of the more than 2,000 named islands in southeast Alaska were surveyed during this time. Thus, there continues to be a gap in knowledge about the natural history and ecology of wildlife subspecies indigenous to Southeast Alaska, and conclusive geographic ranges of many endemics could not be produced (Hanley et al. 2005, Dawson et al. 2007).

The Prince of Wales Island complex appears to be an endemic hotspot based on evidence that it was an area of refugia during the last glacial event (Cook et al. 2001). This has implications for management because there is notable overlap between this area, past timber harvest, and the potential for future timber harvest (Cook et al. 2006). The island archipelago setting of the Tongass and the naturally fragmented landscapes of Southeast Alaska create challenges for management as natural interactions between subpopulations and individuals is problematic, especially for species that cannot move between islands. This is illustrated by the lower genetic variability documented in island populations of northern flying squirrel (*Glaucomys sabrinus*) compared to those on the mainland (Bidlack and Cook 2001, 2002). Other recent research on the demography, systematics, phylogeography, and post-glacial expansion of Southeast Alaska endemics has focused on the red backed vole (*Myodes rutilus* and M. *gapperi*) (Runck 2001, Cook et al. 2004, Smith and Nichols 2004, Runck and Cook 2005, Smith et al. 2005), long-tailed vole (*Microtus longicaudus*) (Conroy and Cook 2000), Keen's mouse (*Peromyscus keeni*) (Lucid and Cook 2004, Smith et al. 2005), dusky shrew (*Sorex monticolus*) (Demboski and Cook 2001), cinereus shrew (*Sorex cinereus*) (Demboski and Cook 2003), ermine (*Mustela erminea*) (Fleming and Cook 2002), marten (*Martes* spp.) (Stone and Cook 2002, Stone et al. 2002), wolverine (*Gulo gulo*) (not endemic, but isolated populations with limited dispersal capability occur in southeast Alaska; Tomasik and Cook 2005), and black bear (*Ursus americanus*) (Stone and Cook 2000, Peacock et al. 2007). Major factors identified by these studies include reduced genetic diversity, limited dispersal capabilities, and the existence of highly divergent or relatively restricted western or Pacific coastal, lineages of some species. This last factor was due to the existence of eastern and western forest refugia in North America during past glacial advances, all resulting in populations that are especially vulnerable to environmental stochasticity and anthropogenic disturbances.

Due to their isolation, island archipelagos themselves are more sensitive to the effects of introduced exotics, emerging pathogens and disease (e.g., canine distemper), and natural events, than other managed landscapes. Therefore, there is a higher probability of extinction on islands due to the restricted ranges of species, patterns of extinction are dynamic (i.e., in higher latitude archipelagos geographic ranges of mammals and recolonization abilities fluctuate with glacial advances and retreats), and the effects of management activities are magnified. In fact, more than 81 percent of mammalian extinctions in the last 500 years have been insular, endemic mammals (Ceballos and Brown 1995 as cited in Dawson et al. 2007). Notably, while the distribution of mammalian species in southeast Alaska is a function of the size of the island on which they occur and distance to the mainland, the distribution of endemic mammals is not (Conroy et al. 1999, Dawson et al. 2007). Thus, designing conservation measures based on island size or location will not effectively maintain the endemic diversity found in this region. Because of the uniqueness of this type of geographic setting and the vulnerability of species within it, some researchers have proposed structuring conservation efforts and land management planning along the North Pacific Coast around the issue of endemism (Cook and MacDonald 2001, Cook et al. 2001).

Wildlife Terrestrial Habitat Question 3: What is the geographic distribution and habitat relationship of mammalian endemic species on the Tongass?

Evaluation Criteria

The geographic distribution and habitat relationship of mammalian endemic species on the Tongass will be determined by reviewing new information. Ongoing research will help to assess the distribution and habitat relationship of endemic mammal species.

Monitoring Results

The University of New Mexico (UNM) and the Tongass continue to collaborate to inventory mammals and their distribution on the Tongass through the ISLES (Island Surveys to Locate Endemic Species) project. In addition, work with the University of Wyoming (UW) is seeking to identify the understory vegetation most important to small mammal (including endemic species) diversity and abundance in young growth forests on Prince of Wales Island.

ISLES

Recent surveys for endemics by UNM in southeast Alaska were initiated in 2009 and have continued annually since. UNM typically collects small mammals using trap-lines of snap and pitfall traps. In some cases, live-traps are used (for animals to be karyotyped) and rat traps may be employed when targeting larger species (like ermine and flying squirrels). UNM also salvages mammal carcasses from cooperating trappers and hunters. All specimens collected are identified using DNA techniques, vouchered, and the information is entered into Arctos (an online database of museum specimen data http://arctos.database.museum/home.cfm) (Cook and MacDonald 2012). The specimens and associated information are geo-referenced for use in a geographic information system (GIS). Specimens from the 2012 season are in process of digitization, cleaning, labeling, and curation.

The 2012 Field inventories in the Prince of Wales Archipelago were conducted on three high-interest islands in Sea Otter Sound and involved five general localities, 27 specific localities, and nearly 7,000 trap nights over a seventeen day period. Trapping yielded 88 individuals in total of species Keen's mouse/Northwestern deer mouse (*Peromyscus keeni*), long-tailed vole (*Microtus longicaudus*), northern Flying Squirrel (*Glaucomys sabrinus*), and dusky shrew (*Sorex monticolus*). Table 1 summarizes the species captured by location and year since 2009.

During the 2011-2012 fur-bearer trapping season in southeast Alaska, cooperating trappers secured an additional 108 samples of marten plus several river otters, ermine and flying squirrel from Dall, Suemez, Sukkwan, and Prince of Wales islands. Prior to fieldwork in 2012, all were necropsied for parasites and prepared for permanent archiving. In addition, 32 marten, a deer, and a river otter from northern southeast Alaska were sent to the ISLES project from Sitka.

There are several noteworthy highlights from the 2012 ISLES surveys. There was a six-fold decrease in small mammal captures per 100 trap hours from the 2011 season. This is the lowest capture rate the project has experienced for any set of sites in the entire geographic region. This may be a result of extreme year-to-year population fluctuations. There were no small mammals documented on White Cliff Island in 1,260 trap nights. Past efforts yielded shrews and mice on nearby Eagle, Owl, and Hoot islands (MacDonald and Cook 2007). The first records of roughskin newts (*Taricha granulosa*) on Heceta and Tuxekan Islands. No western toads (*Anaxyrus boreas*) were encountered. Mink and deer were seen at all localities. Black bear were not recorded either on Heceta or White Cliff islands. Wolf sign was noted on Heceta and Tuxekan islands. River otters were seen on Tuxekan Island. (Cook and MacDonald 2012)

Wildlife Terrestrial Habitat 3 Table 1. Species trapped by location and year

Year	Location	Species
2009	Haines area	northwestern deer mouse; northern red-backed vole; meadow vole; long-tailed vole; red squirrel; cinereus shrew; dusky shrew; least weasel
	Wrangell Island	northwestern deer mouse; southern red-backed vole; long-tailed vole; northern bog lemming; red squirrel; cinereus shrew; dusky shrew; water shrew
	Woronofski Island	northwestern deer mouse
	Vank Island	northwestern deer mouse
	Sokolof Island	meadow vole
	Onslo Island	northwestern deer mouse; southern red-backed vole; red squirrel; cinereus shrew; dusky shrew
	Eagle Island	southern red-backed vole
	Zarembo Island	northwestern deer mouse; long-tailed vole; red squirrel; dusky shrew; ermine
	Shrubby Island	northwestern deer mouse; dusky shrew
2010	Baker Island	northwestern deer mouse; dusky shrew
	Santa Rita Island	northwestern deer mouse; dusky shrew
	St. Ignace Island	northwestern deer mouse
	Noyes Island	northwestern deer mouse; dusky shrew; long-tailed vole
	San Lorenzo (west island)	none
	Cone Island	northwestern deer mouse; dusky shrew
	Lulu Island	northwestern deer mouse; dusky shrew; long-tailed vole
	San Fernando	northwestern deer mouse; dusky shrew
2011	Haines area	northwestern deer mouse, northern red-backed vole, meadow vole, red squirrel, cinereus shrew
	Revillagigedo Island	northwestern deer mouse, southern red-backed vole, dusky shrew
	Prince of Wales Island	Northwester deer mouse, long-tailed vole, dusky shrew, northern flying squirrel
	Prince of Wales - Alpine	Northwestern deer mouse, long-tailed vole, dusky shrew, ermine
	Suemez Island	northwestern deer mouse, dusky shrew
	Shelikof Island	northwestern deer mouse, long-tailed vole, dusky shrew, northern flying squirrel
	Dall Island	northwestern deer mouse, dusky shrew, northern flying squirrel
	Dall Island - Alpine	northwestern deer mouse, long-tailed vole, dusky shrew
	Goat Island	northwestern deer mouse, long-tailed vole, dusky shrew
	Sukkwan Island	Northwestern deer mouse, long-tailed vole, dusky shrew, northern flying squirrel
	Etolin Island - Alpine	southern red-backed vole, cinereus shrew, dusky shrew
2012	Heceta Island	northern flying squirrel, northwestern deer mouse, dusky shrew
	Tuxekan Island	northern flying squirrel, northwestern deer mouse, long-tailed vole, dusky shrew
	White Cliff island	(no captures)

Small Mammal and Carnivore Response to Tongass Young-growth Treatments

Field work on this cooperative project with UW started summer, 2010, and continued in 2011 and 2012. The objectives of this study are to develop predictive models of small mammal responses to thinning manipulations for future use in adaptive management of young growth stands on the Tongass, identifying those variables that respond to young growth treatments which best correlate with higher abundance and vital rates of small mammals, and to evaluate the responses of ermines and martens to effects of young growth treatment on small mammals.

To accomplish these objectives, live-trap sampling grids were established in Tongass-wide Young-growth Study (TWYGS) treatment and control (un-thinned young-growth) stands, unlogged old-growth stands, and in clear-cuts on Prince of Wales Island. Baited live-traps are used to target small mammals and ermine. Baited hair snares are used to "capture" marten. Traps and hair snares are set from late spring (May) to late summer (August). Trapped mammals are weighed, measured, sexed, aged (small mammals only), assessed for reproductive status (small mammals only), and marked with a passive integrated transponder tag for permanent identification. Blood and tissue samples are taken from anesthetized animals and feces are collected opportunistically for diet analysis (Ben-David et al. 2010). Beginning in 2012, crew sub-sampled all trapping grids with track tubes as an alternative method of assessing populations of small mammals. Track tubes record the footprints of any small mammal that enters the tube and allow determination of presence without live capture. Table 2 summarizes the mammal capture 2010 through 2012.

Wildlife Terrestrial Habitat 3 Table 2. The number of unique individuals of small mammals caught per species by year and the percent change in number of individuals captured between trap-years 2011 and 2012

SPECIES	2010	2011	2012	% Change 2011 - 2012
Keen's Mice (*Peromyscus keeni*)	870	1508	143	-91
Dusky Shrew (*Sorex monticulus*)	404	583	709	+22
Long-tailed Vole (*Microtus longicaudus*)	7	11	0	-100
Northern Flying Squirrel (*Glaucomys sabrinus*)	1	26	9	-65
Ermine (*Mustela* ermine)	7	17	7	-59
Marten (*Martes* spp.)	7	20	25	+20

There were drastic fluctuations in the new individual Keen's mice trapped between years. From 2010 to 2011 the new Keen's mice trapped increased by 56 percent (only considering the 19 original trapping grids) and then a 91 percent increase was observed between 2011 and 2012. In addition, new individual dusky shrews trapped increased fairly dramatically between 2011 and 2012.

Vegetation and habitat surveys were also conducted in 2010 through 2012. Habitat measures were taken at each sampling grid including: tree canopy cover, height, closure, density and diameter at breast height; biomass; slash depth, decay, and cover; frequency of occurrence of potential food items (e.g. fungi, berries, conifer cones, and flightless soil macro-invertebrates) (Ben-David et al. 2010). Surveys in 2011 and 2012 were completed largely to note inter-annual differences in plant performance and the availability of small mammal forages (Ben-David et al. 2011). Table 3 summarizes the number of these surveys, by year, and type.

Wildlife Terrestrial Habitat 3 Table 3. The number of surveys for habitat characteristics and forages conducted in 2010-2012

HABITAT/FORAGE SURVEY TYPE	2010	2011	2012
Plant Species Biomass Plots	684	0	0
Canopy Overstory Survey	171	0	0
Canopy Closure (Ceptometer and Photo Analyses)	57	16	0
Line –transect Plant Survey	171	168	168
Cone Counts and Truffle Surveys	684	671	672
Invertebrate Survey	855	80	0

Results of the analysis of canopy photos taken in 2010 suggest that this method is not sensitive to differences between un-thinned young-growth and old-growth stands and between thinning treatments. In 2012 a manuscript entitled "Linear sensors better capture stand-type differences in leaf area index than hemispheric photography in the coastal rainforest of southeast Alaska" was submitted to the *Journal of Agricultural and Forest Meteorology*. Preliminary project results were presented at the national Wildlife Society meeting in Portland, Oregon.

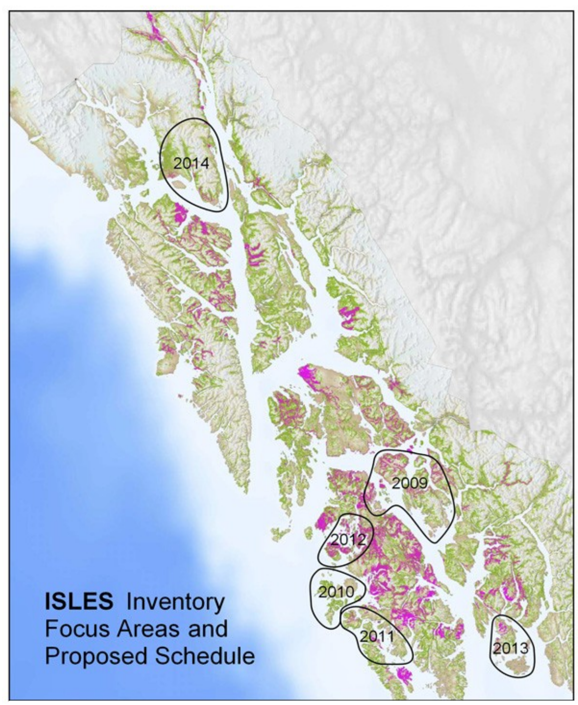
Evaluation of Results

This new information does not support a need for change to the Forest Plan. Assessing biotic change begins with modern inventory studies and long-term monitoring programs that can be used to develop more rigorous databases. Ideally, these databases will be based on permanently archived museum specimens that have been collected over many years and contain representatives from environmental gradients throughout a given region. The Tongass continues to work towards filling these information gaps as funding becomes available. In addition, work will continue to identify habitat relationships and the effects of young-growth and young-growth treatments on small mammals and their predators. This work will inform our management of young growth as well as our monitoring of management effects on wildlife habitat and forages in the understory.

Action Plan

ISLES

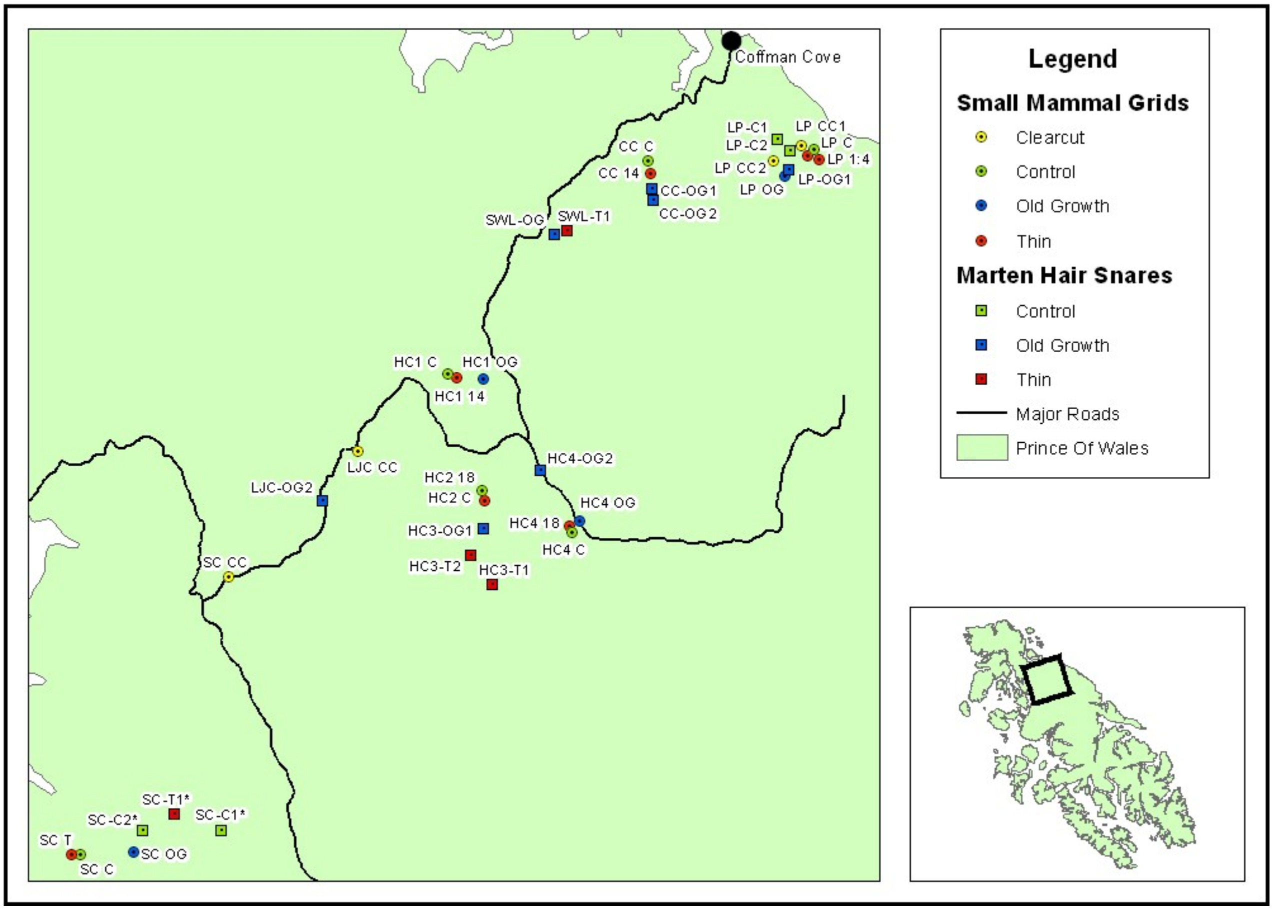
The project is planned with a similar protocol for 2013 field seasons. The general location of these surveys is illustrated in figure 1. Logistical planning for the 2013 field season is in progress for surveys on the Ketchikan Ranger District. Completion of the project is planned for FY 2013.



Wildlife Terrestrial Habitat 3 Figure 1. ISLES survey locations by year

Small Mammal and Carnivore Response to Young-growth Treatments

Figure 2 illustrates the UW survey locations planned to be repeated through 2014. This work is scheduled to be completed December 31, 2014. Near-term plans are to estimate use of stands and treatments by small carnivores, analyze small mammal data in the context of changes in abundance over the past three years, comparing habitat characteristics between treatments and across landscape, complete a fourth season of data collection in 2013, continue DNA analysis to identify individual marten and stable isotope analyses for diet assessments, and complete data analysis of habitat and vegetation characteristics of all sampling stands, as well as mesocarnivore data graduate theses, in 2013 and 2014.



Wildlife Terrestrial Habitat 3 Figure 2. Map of the UW survey locations to be repeated through 2014
Courtesy of UW

Citations

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