Colorado Division of Parks and Wildlife
July 2015 – June 2016

WILDLIFE RESEARCH REPORT

State of:	Colorado	:	Division of Wildlife
Cost Center:	3430	:	Mammals Research
Work Package:	3003	:	Predatory Mammal Conservation
Task No.	3	:	Black bear exploitation of urban environments: finding management solutions and assessing regional population effects
Federal Aid Project No.	W-204-R5		

Period Covered: July 1, 2015 – June 30, 2016

Author: H. E. Johnson

Personnel: H.E. Johnson, S.A. Lischka, J. Broderick, J. Apker, S. Breck, J. Beckmann, K. Wilson, and P. Dorsey.

ABSTRACT

Across the country conflicts among people and black bears are increasing and have become a high priority for wildlife management agencies. Whether increases in conflicts reflect recent changes in bear population trends or just bear behavioral shifts to anthropogenic food resources, is largely unknown, with key implications for bear management. This issue has generated a pressing need for bear research in Colorado and has resulted in a collaborative study involving Colorado Parks and Wildlife (CPW; lead agency), the USDA National Wildlife Research Center, Wildlife Conservation Society and Colorado State University. Collectively, we have implemented a study on black bears that 1) determines the influence of human development on bear demography and behavior, 2) tests a management strategy for reducing bear-human conflicts, 3) examines public attitudes and behaviors related to bear-human interactions, and 4) develops population and habitat models to support the sustainable management of bears in Colorado. This project was initiated in FY2010-11; during this past fiscal year we focused on collecting field data in the vicinity of Durango and modeling demographic parameters from known-fate and mark-recapture data. With respect to data collection, we worked with collaborators and stakeholders on research logistics, trapped and marked black bears, monitored bear demographic rates through telemetry and winter den visits, tracked human-related bear mortalities and removals from the study area, collected GPS collar location data from bears along the urban-wildland interface, monitored the availability of summer/fall mast, obtained data on garbage-related bear-human conflicts, assessed resident use of project-supplied bear-resistant containers, and surveyed residents about their attitudes and behaviors with respect to bears. Information from this study will provide solutions for sustainably managing black bears *outside* urban environments, while reducing bear-human conflicts *within* urban environments; knowledge that is critical for wildlife managers in Colorado and across the country.

WILDLIFE RESEARCH REPORT

BLACK BEAR EXPLOITATION OF URBAN ENVIRONMENTS: FINDING MANAGEMENT SOLUTIONS AND ASSESSING REGIONAL POPUATION EFFECTS

HEATHER E. JOHNSON

PROJECT NARRATIVE OBJECTIVES

The objectives of this project are to 1) determine the influence of urban environments on bear demography and behavior, 2) test a management strategy for reducing bear-human conflicts, 3) examine public attitudes and behaviors related to bear-human interactions, and 4) develop population and habitat models to support the sustainable management of bears in Colorado.

SEGMENT OBJECTIVES

1. Work with personnel from CPW Area 15, CPW Southwest Region, City of Durango, La Plata County, US Forest Service, Bureau of Land Management, Southern Ute Tribe, and private landowners on field research logistics.

2. Trap and collar adult female black bears in the vicinity of Durango to collect data on bear demography and behavior.

3. Track bear movements and survival via global position system (GPS) collar locations.

4. Monitor bear fecundity and cub survival through winter den investigations of collared adult female bears.

5. Obtain data on natural food conditions for bears based on the abundance of mast from gambel oak, serviceberry, chokecherry, hawthorne, pinyon pine and native crabapple.

6. Track human-related bear mortalities and removals around Durango from lethal conflict management, vehicle collisions, harvest, and translocations.

7. Assess the efficacy of wide-scale urban bear-proofing for reducing bear-human conflicts by quantifying conflicts in areas with and without bear-resistant containers.

8. Examine human behavior by monitoring resident compliance with wildlife ordinances in neighborhoods that were provided with bear-resistant garbage containers.

9. Survey residents in the study area about their attitudes and behaviors with respect to black bears.

INTRODUCTION

In Colorado and across the country, conflicts among people and black bears (*Ursus americanus*) appear to be increasing in number and severity (Hristienko and McDonald 2007, Baruch-Mordo et al. 2008, CPW unpublished data). Bear-human conflicts can result in public safety concerns, property damage, bear mortality (i.e., euthanasia), and high management costs, and thus, have become a critical wildlife management issue. While wildlife agencies have used a variety of tools to try to minimize bear-human conflicts (i.e., education, aversive conditioning of bears, and increased harvest), conflict rates have continued to rise. Whether increases in bear-human conflicts reflect recent changes in the bear population or just behavioral shifts to anthropogenic food resources, is largely unknown, as bear population parameters have been exceedingly difficult to estimate (Garshelis and Hristienko 2006). Without a

thorough understanding of the relationship between conflict rates and bear behavior and population dynamics, it has been difficult for wildlife agencies to successfully reduce conflicts through bear management.

While there is uncertainty about how to reduce bear-human conflicts, two key factors thought to exacerbate this problem are expanding human development and climatic variation. Colorado has had one of the highest rates of exurban development in the nation (Theobald and Romme 2007), and this development has resulted in additional human food on the landscape in the form of garbage, fruit trees, livestock, birdfeeders, etc. The availability of human food to bears has been identified as the primary cause of bear-human conflicts (Spencer et al. 2007, Beckmann et al. 2008, Greenleaf et al. 2009), as bears are opportunistic foragers that will readily take advantage of novel resources. Bear-use of human food not only increases interactions between bears and people but has been associated with changes in bear activity patterns, foraging behavior, movement rates, and even survival and reproductive rates (Beckmann and Berger 2003a, Beckmann and Berger 2003b, Hostetler et al. 2009), having the potential to significantly influence both bear demography and behavior. This phenomenon is further complicated by variation in annual weather patterns, as bear-use of human development appears to increase when natural foods are in short supply (Zack et al. 2003, Baruch-Mordo et al. 2010). Because bears predominately consume vegetation, recent patterns of drought in Colorado have caused natural food failures for bears in some years. As a result, bears may be increasing their reliance on human foods, with associated behavioral and demographic impacts. While the effects of urbanization and climate have critical implications for modifying bear-habitat relationships, they also have critical implications for increasing rates of bear-human conflicts. To develop successful strategies to reduce conflicts while maintaining viable bear populations, wildlife agencies must understand how factors such as climate, natural food availability, human food ability, and management influence the behavior and dynamics of bear populations.

To address these questions, Colorado Parks and Wildlife has partnered with the USDA National Wildlife Research Center, Wildlife Conservation Society and Colorado State University. Collectively, we initiated a project in FY10-11 to 1) determine the influence of urban environments on bear behavior and demography, 2) test a management strategy for reducing bear-human conflicts, 3) examine public attitudes and behaviors related to bear-human interactions, and 4) develop population and habitat models to support the sustainable management of bears in Colorado (Johnson et al. 2011). This information should provide solutions for sustainably managing black bears *outside* urban environments, while reducing bear-human conflicts *within* urban environments; knowledge that is critical for wildlife managers in Colorado and across the west.

During FY14-15, we worked with collaborators and stakeholders on research logistics, trapped and marked black bears, monitored bear demographic rates (adult female survival, adult female fecundity and cub survival) through telemetry and winter den visits, tracked human-related bear mortalities and removals from the study area, collected GPS collar location data on bears along the urban-wildland interface, monitored the availability of summer/fall mast, obtained data on garbage-related bear-human conflicts, assessed resident use of project-supplied bear-resistant garbage containers, and surveyed residents about their attitudes and behaviors with respect to bears. Our efforts focused largely on collecting field data to meet research objectives 1-3, and initiating the development of bear population models to meet objective 4. We report general summary information from field activities over the past year; detailed analyses of field data are ongoing.

STUDY AREA

To meet study objectives, we are using a combination of site-specific field data and statewide data. Site-specific field data are being collected in the vicinity of Durango, Colorado and are the focus of

this progress report. The town of Durango contains ~17,000 people (within city limits) and sits at 1,985 m along the Animas river valley. The town is surrounded by mountainous terrain ranging in elevation from ~1,930 to ~3,600 m, and is generally characterized by mild winters and warm summers that experience monsoon rains. Vegetation in the region is dominated by ponderosa pine, oak, pinyon pine, juniper, aspen, mountain shrubs, and agriculture. Key forage species for black bears include gambel oak (*Quercus gambelii*), chokecherry (*Prunus virginiana*), serviceberry (*Amelanchier alnifolia*), hawthorne (*Crataegus spp*), native crabapple (*Peraphyllum ramosissimum*) and pinyon pine (*Pinus edulis*). Durango is predominately surrounded by public land managed by the San Juan National Forest, Bureau of Land Management, Colorado Parks and Wildlife, La Plata County and the City of Durango. The vicinity of Durango is considered high quality bear habitat, and the town has consistently experienced high rates of bear-human conflicts (Baruch-Mordo et al. 2008, CPW unpublished data).

METHODS

Objective 1: Determining the influence of urban environments on bear demography and behavior

To sustainably manage bears in the face of a growing human population and changing landscape conditions, it is critical to elucidate the drivers and dynamics of bear populations. Of those factors that influence bear populations, the expansion of human development is the least understood, most contentious, and has the greatest potential to elicit major population change. To elucidate the influence of human development on bear demography and behavior, we are collecting a suite of data types including survival and reproductive rates of bears in conjunction with their habitat-use patterns, information on annual summer/fall mast production, and genetic data to estimate bear density in urban and wildland habitats using mark-recapture methods. We briefly describe data collection methods for this portion of the study below; detailed information is available in Johnson et al. (2011).

Collaring and Marking Bears – To assess bear demographic rates and behavior with respect to human development, we are capturing and collaring adult female bears. We are specifically targeting adult females as they represent the reproductive segment of the population and allow us to obtain information on multiple key vital rates that drive population growth. For example, in addition to being able to track adult female survival, the vital rate with the highest elasticity (Beston 2011), we can use collared females to track fecundity and cub survival, the vital rates that are typically associated with variation in bear population trends (Mitchell et al. 2009, Beston 2011).

We have focused summer trapping efforts within ~10 km of Durango to collar a cohort of bears that experience similar natural food conditions, have anthropogenic food resources readily available, and encompass a range of behaviors and habitat-use patterns relative to the urban-wildland interface. Bears are trapped with box traps, which are baited with fish, road kill, fruit, human foods (at urban locations) and manufactured scents. Traps are set in the evening and checked the following morning. Adult female bears are fitted with a GPS collar (manufactured by Vectronics), and a tooth (first pre-molar) is pulled for age verification. GPS collars record bear locations every hour, and upload a real-time location to a central database via satellite every 6 hours. Although trapping efforts are focused on adult females, all bears that are trapped (i.e., males, subadults, yearlings) are uniquely marked with a PIT and ear-tag and are weighed, measured, and sampled for blood and hair.

Estimating Demographic Rates – To assess the influence of human development on bear demographic rates we have been collecting the following data types: 1) survival and reproduction of collared adult female bears, 2) cub survival monitored during annual winter den checks of collared females, 3) mortalities and removals of marked and unmarked bears in the vicinity of Durango, and 4) non-invasive genetic surveys that estimate density and abundance of bears around urban and wildland sites.

Collared female bears allow us to estimate annual adult female survival, fecundity (number of cubs born/adult female) and cub survival (survival from newborn cub to yearling); parameters we have

monitored since summer 2011 and which we will continue to monitor through winter 2017. We use real-time GPS collar locations to assess adult female survival, investigating mortalities and slipped collars when GPS locations are stationary during multiple fixes. Fecundity and cub survival are monitored from winter den checks of collared females. Numbers of newborn cubs provide information on fecundity, while consecutive annual den checks of collared females allow us to estimate cub survival. Because yearlings hibernate with their mothers, we can observe the number of cubs alive in the den in year *t* that survived their first year of life to *t+1*. Adult female survival, fecundity and cub survival will be used in matrix projection models to assess population performance (Caswell 2001), particularly in relation to bear use of human development.

In addition to tracking survival and reproduction of collared bears, we are also tracking survival and cause-specific mortality of marked (i.e., males, subadults) and unmarked bears in the study area. All bears that are trapped are marked with an ear-tag and PIT tag, unique identifiers that we are using to collect data on human-related bear mortalities and removals. Mortalities and removals primarily occur from translocations, vehicle collisions, conflict-related euthanasia and hunter harvest. For all bears that are removed from the study area we collect a hair and tooth sample and record the date, mortality/removal cause, location, bear age, sex, weight, and morphological measurements. We will use mark-recapture and recovery data to estimate adult male and subadult survival, while also gaining valuable information on cause-specific bear mortality.

To better understand the influence of urban environments on bear density and abundance, we have employed non-invasive genetic sampling (Woods et al. 1999, Mowat and Strobeck 2000) to compare these parameters between the bear population around Durango and for a nearby "wildland" area. For each area we identified a 36 cell grid (576 km^2) where each cell was 4 x 4 km in size. We constructed and monitored 1 snare site within each cell. Snares consisted of a scented bait hanging high in a tree, surrounded by barbed wire around a cluster of trees encircling the bait (wire was strung 50 cm above ground). When bears climb over or under the wire to investigate the bait, they leave a hair sample on the barbed wire. During summers 2011 through 2014, we deployed snares during the first 2 weeks of June, and conducted 6 weekly sampling occasions thereafter. On each occasion, we randomly re-baited the snare with a scent (anise, berry, fish, maple or bacon), and collected hair samples from all barbs. All hair samples were sent to Wildlife Genetics International (Nelson, British Columbia, Canada) for genotyping.

This past year, we used genotype data to estimate female bear abundance and density around Durango. We used an integrated modeling approach that combined spatially-explicit capture-mark-recapture data (SCR) from non-invasive hair snags and location data from GPS-collared females into a single unified analysis (Royle et al. 2013). This approach provided annual estimates of female population abundance, density, and population growth rate and annual estimates of resource selection parameters at the 2^{nd} and 3^{rd} order (Johnson 1980). Between 2011 and 2014, during June and July, non-invasive genetic sampling resulted in the annual detection of 41–61 females and the annual monitoring of 12–34 GPS-collared females. We modeled 3^{rd}-order resource selection as a function of 15 spatial covariates previously identified as important predictors of black bear space use (Johnson et al. 2015) and as a function of distance from a bear's summer home range center. We modeled spatial variation in black bear density (i.e., 2^{nd}-order resource selection) as a function of 4 spatial covariates including elevation, human development, stream density, and a forest classification that included a mixture of aspen, mesic montane, and mixed-conifer forest types. We fit 15 models that included all combinations of the 4 density covariates and a null model that assumed constant density across space. We also fitted 4 additional models that added an interaction term between forest and development to models in the previous model set that contained both covariates. We added a second-order polynomial term for elevation to all models that contained that covariate. We used AIC-based model selection and multi-model inference to rank candidate models and derive model-averaged parameter estimates. To evaluate the potential benefits of integrating GPS data in to our analysis, we also fit the same set of candidate models for abundance and density within a standard SCR framework (no GPS data) that assumes a bivariate-normal space-use model for comparison.

Evaluating Bear Movement and Habitat-Use Relative to the Urban-Wildland Interface – To examine movement and habitat-use patterns of bears along the urban-wildland interface, we are using GPS location data from collared females. Hourly GPS data are downloaded from the collars in the field on a biannual basis (fall and winter). Locations are being used to assess the influence of factors such as natural food availability, human food availability, weather, habitat covariates, and individual bear attributes (i.e., age, reproductive status) on bear movement and resource selection patterns (Manly et al. 2002, McLoughlin et al. 2010, Morales et al. 2010, Johnson et al. 2015). For spatial covariate data, we have generated rasters representing elevation, aspect, slope and terrain ruggedness using digital elevation models. We also created rasters depicting distances to drainages and perennial water using the National Hydrology Dataset, and have estimated the proportion of different vegetation types using the USFS LandFire dataset (http://www.landfire.gov/vegetation.php). We derived rasters depicting human structure and road densities using data from La Plata county and CPW. Weather information has been acquired from local weather stations and from PRISM nationwide datasets (www.prism.oregonstate.edu/).

While most habitat and human development information can be extracted from existing spatial data sources, there is no existing data layer that tracks annual variation in late summer/fall hard and soft mast for bears. The abundance of berry and nut resources for bears is known to be highly variable, depending on annual trends in precipitation and temperature (Noyce and Coy 1989). To account for variation in the availability of natural forage for bears around Durango, we conduct bimonthly mast surveys. Surveys are performed from late July through mid-September, when berries and nuts should reach peak maturation. Key mast species for bears around Durango are gambel oak, chokecherry, serviceberry, hawthorne, native crabapple, and pinyon pine (Beck 1991, Tom Beck, personal communication). We randomly selected 15 transects on public lands to evaluate bear mast availability. Each transect is 1 km in length and situated along an existing trail or stream drainage. For each species, along each transect, field technicians qualitatively assess the phenological stage (immature fruits/nuts, peak maturation, etc) and abundance of mast (proportion of plants with no mast, scarce fruits/nuts, moderate fruits/nuts, etc).

Objective 2: Testing a management strategy to reduce bear-human conflicts

Given that the primary cause of black bear-human conflicts has been attributed to the availability of human foods to bears, it has been suggested that the most effective strategy to reduce conflicts is to reduce the availability of that resource (Peine 2001, Beckmann et al. 2004, Gore et al. 2005, Spencer et al. 2007). This strategy has had some success within national parks (Greenleaf et al. 2009), and anecdotally in some communities (Mammoth Lakes CA, Juneau AK, Whistler BC), but no research has ever scientifically tested the benefits of "cleaning up" a town. Given the high price to operationally "bear-proof" a community, many municipalities must have definitive evidence that such an effort would significantly decrease conflict activity before initiating major changes to waste storage and collection practices.

As part of this project, we are implementing the first experimental test of wide-scale urban bear-proofing for reducing bear-human conflicts. As part of the experiment we have designated 2 residential 'treatment' areas and 2 paired 'control' areas, consisting of a total of ~2,000 homes. In spring and early summer 2013 we deployed ~900 bear-resistant garbage containers within the treatment areas (approximately 100 homes already had these containers) with the goal that regular receptacles were exchanged with bear-resistant containers for all residents. In spring and early summer 2014 we deployed an additional ~150 containers to "clean-up" treatment areas, ensuring that all residences had a bear-resistant container. In July 2013, 2014 and 2015 we also canvassed homes within treatment areas, reminding residents to lock their bear-resistant garbage containers and asking that they bear-proof their properties (remove bird feeders, outdoor pet food, and other bear attractants); no canvassing occurred in control areas. Additionally, we increased enforcement of wildlife ordinances within treatment areas, providing official warnings at residences with bear-strewn trash and notifying city code enforcement for subsequent ticketing.

To track the effectiveness of these efforts in reducing bear-human conflicts we are collecting pre- and post-treatment data. For 2 years pre-treatment, summers 2011 and 2012, field technicians patrolled streets within proposed treatment and control areas on the day waste removal was scheduled to occur (when maximum human food was assumed to be available to bears). Technicians conducted patrols from 5:00 – 7:00 am and recorded locations of bear-strewn trash. Monitoring occurred from July through September, months that experience the highest numbers of bear-human conflicts in Durango (CPW unpublished data). During summers 2013-2015 project personnel collected post-treatment data, conducting surveys twice/week; post-treatment data will be collected through 2016. Once the experiment is complete, we will use data from pre- and post-treatment years, and from treatment and control areas, to quantify the effectiveness of residential bear-proofing. In addition to our observations of bear-strewn trash, we will use conflict calls to the CPW Area 15 Office to examine differences in conflict rates pre- and post-treatment, and across treatment and control areas.

Objective 3: Identifying public attitudes and behaviors related to bear-human encounters

Wildlife management agencies must identify the biological factors driving increases in bear-human conflicts, but they also must identify and incorporate human attitudes and perceptions about this issue into management strategies. This is particularly critical for black bears, as increasing bear-human conflicts around urban development have stimulated significant public interest and concern. It is also critical because bear-human conflicts typically arise over bear-use of human foods, prompting investigators to suggest that a critical component of reducing conflicts is managing human behavior (Beckmann et al. 2004, Gore et al. 2008, Baruch-Mordo et al. 2011). Thus, we have initiated efforts to better understand human attitudes related to bears and bear-human interactions, and human behaviors related to the appropriate use of bear-resistant garbage containers.

To assess data on human attitudes, we are using public mail surveys to 1) quantify perceptions about bears, bear management, and bear-human interactions, and 2) explore motivations for compliance and non-compliance with wildlife ordinances designed to reduce bear-human conflicts. To meet these objectives, we developed a three-part mail survey, conducted in conjunction with our urban bear-proofing experiment. Residents were surveyed pre- (2012), during (2014), and post-implementation (2016) of the experiment, in treatment and control areas, as well as across a larger portion of the community. Johnson et al. (2012) and (2014) provide detailed information about the 2012 and 2014 surveys, respectively. The 2016 survey occurred between January and June 2016 (Appendix 1), where all residents within the city limits of Durango and a sample of residents within the county were asked about their interactions with bears, perceptions of management actions to reduce conflicts, and household actions to reduce conflict. The survey was mailed to a total of 6,566 individuals and we had a valid sample of 5,449 (1,117 surveys were invalid because they could not be delivered to the intended recipients). Responses are currently being electronically recorded. Survey responses will allow us to quantify current attitudes and perceptions about bear-human interactions, and how those perceptions have changed over time in association with a management effort such as wide-scale urban bear-proofing. Survey data will also identify the number of residents that have had interactions with bears, the acceptability of management actions by CPW, and factors that promote or inhibit residents from complying with wildlife ordinances.

In addition to collecting data on human attitudes and perceptions, we are also collecting data on human behavior through direct observations. Using a random, stratified sampling design we are monitoring human compliance with wildlife ordinances at residences in treatment and control areas. Durango city ordinances specify that garbage can only be accessible after 6:00am on the morning of pick-up; therefore, we define compliance as having garbage adequately secured so that bears cannot access it, either through appropriate use of a bear-resistant garbage container (e.g. latched lid) or by keeping garbage enclosed in a garage or shed until the morning of trash pick-up. Non-compliance is defined as allowing garbage to be accessible to bears by not latching a bear-resistant container or putting a regular garbage container at the curb the night before garbage pickup.

To assess compliance, we observe residences on the morning of garbage pick-up (5:00-6:00 am) between July and September. Compliance monitoring began in 2013 and will continue through 2016. In each treatment and control area, a sample of 40 randomly selected blocks are monitored (a total of 160 blocks) such that the number and type of cans (regular or bear-resistant) and compliance status are recorded. Each block is surveyed three times/summer. In the north experimental area, compliance is recorded for each parcel, but in the south experimental area, compliance is recorded per block because garbage containers are stored along alleys and cannot be easily tracked to parcel. Compliance data will be analyzed in conjunction with mail survey data, spatial covariates, and conflict activity to better understand how factors such as management actions and rates of bear-human interactions influence human behavior. This should help CPW tailor education and communication efforts to be more effective at achieving public compliance with wildlife ordinances.

RESULTS AND DISCUSSION

Objective 1: Determining the influence of urban environments on bear behavior and demography

Between 5 July 2015 and 23 March 2016 (the 2015-2016 capture year), an additional 54 unique bears were marked during 136 bear captures (Table 1). To date on the project there have been 380 different individuals marked during 891 captures. Information about these captures is described below for summer 2015 and winter 2016.

During summer 2015 we conducted 56 total bear captures; 29 captures were newly marked unique individuals and 27 were recaptures. Of the unique individuals captured, there were 7 females and 20 males (Table 1). We placed collars on 5 new adult females. Including bears that were already collared at the start of the summer, this resulted in 38 collars deployed by mid-September, the end of the summer capture season. The mean estimated age of bears ≥1 year-old on their initial capture date was 5.0 (7.0 for females and 4.6 for males), and the mean weight was 78.4 kg (73.5 kg for females and 79.6 kg for males). In total, we placed traps at 43 different locations and conducted 767 trap nights. Capture success peaked in late August and early September (Figure 1). Capture effort was slightly reduced from previous years, as we only needed to collar a few additional female bears to maintain our target sample size.

Between January and March 2016, we visited the winter dens of 34 collared females. Although we had 38 female bears collared at the end of the trapping season in mid-September 2015, 4 bears lost their collars in September and October due to faulty ‘spacers’. In case we cannot recapture a bear, we always attach collars using a biodegradable spacer (designed to rot off >12 months post-deployment). Fabricon, our manufacuture, had given us a new spacer design this past year that was prematurely rotting off; the problem was subsequently rectified. Of those 34 dens that we visited, we processed bears in 30 dens; 2 dens were too dangerous to enter and 2 bears left the dens when we approached and never re-denned during the field season (both were barren). We obtained reproductive information from all 34 collared bears (trail cameras were used on the dens that were too dangerous to enter): 7 were barren, 15 had yearlings (24 yearlings in total; 13 females, 10 males, and 1 unknown [confirmed on trail camera]), and 12 had newborn cubs (25 cubs in total; 10 females and 15 males). Of those females with newborn cubs, 3 bears had only 1 cub, 5 bears had twins, and 4 bears had triplets. We PIT and ear-tagged yearlings in the den, recorded information on weight, body size, body condition, and collected hair and blood samples. We also PIT tagged newborn cubs, and recorded their sex and weight. We found that reproductive success, measured as the number of cubs/adult female ≥4 years old was 0.74 (SE=0.15) for winter 2016; previous fecundity rates have varied between 0.58 and 1.28. Annual cub survival (survival from newborn to 1 year) was 0.66 (SE=0.08; based on 33 cubs) which was the highest rate observed during the study. Previous annual values have varied from 0.42 to 0.54.

Between 1 April and 30 March 2016 (based on when bears emerge from their dens each spring), annual survival of collared adult female bears was 0.88 (SE=0.05), which is close to the 5 year study average (range: 0.82 – 0.94). Four collared bears died during the year: 2 died in vehicle collisions, 1 was harvested and 1 died of unknown causes (the bear was estimated to be 16+ years old). Throughout the

study area, a total of 41 bears (marked and unmarked) died or were translocated. Sixteen bears were killed in vehicle collisions, 14 were legally harvested, 6 were lethally removed for nuisance behavior, 2 died of unknown causes, 2 were translocated, and 1 was electrocuted (cub climbing a power pole). Of those mortalities there were 9 adult males, 8 adult females, 6 subadult males, 2 subadult females, 2 male cubs, 2 female cubs, and 1 cub of unknown gender. Seventeen of those bears were unmarked and 13 had been marked by research personnel. Additionally, 2 marked bears died outside the study area; both were males that were legally harvested.

To date, we have obtained >705,000 locations from GPS collars on 83 different adult female bears; 46 different bears provided 113,973 GPS locations during the summer of 2015 (Figure 2). Collared bears generally stayed within the vicinity of Durango; there were no extraordinary movements recorded this past year. The furthest a bear traveled to the north was up Hermosa Creek, to the east was Vallecito Reservoir, to the south was the Colorado-New Mexico border, and to the west was the La Plata River.

The availability of natural mast foods was generally moderate in late summer and fall 2015 (Figure 3). Surveys demonstrated that the peak time for mast maturation of native crabapple was early August, serviceberry was between mid-August and mid-September (depending on transect location), chokecherry was early September, hawthorne was mid-September, gambel oak was mid-September, and pinyon pines was in mid- to late-September. Generally, the maturation of soft and hard mast occurred later in 2015 than in previous years. On transects that had key mast species, mast was present on about 25% of chokecherry, 15% of native crabapple, and 10% of oak and serviceberry shrubs, while approximately 30% of pinyon pines produced moderate to abundant cones. Hawthorne berries were only observed on 1 transect, but production was abundant on 80% of those plants. While mast from important species like oak and chokecherry were relatively low in 2015, mast from native crabapple and pinyon pines were quite high; pinyon pines had >3 times the mast that had been observed during any previous year of the study (Figure 3).

Based on a study area size of 840km^2, integrated spatially-explicit capture-mark-recapture models (IntSCR) estimated that female bear abundance in the vicinity of Durango was 156.6 (SE = 22.2) in 2011, 182.7 (SE = 35.7) in 2012, 83.7 (SE = 9.8) in 2013, and 76.2 (SE = 11) in 2014. Density estimates ranged from 0.09 (SE = 0.01) to 0.22 (SE = 0.04; Figure 4). Model averaged estimates of abundance and density based on standard SCR models (using only hair-snare data, no GPS data) were typically greater than the integrated-SCR estimates and were generally less precise (Figure 4). We identified the following models as the top-ranked model for each year, respectively; 2011: forest-only model, 2012: development-only model, 2013: development and elevation model, and 2014: elevation-only model. Predicted density surfaces derived from model-averaged estimates are provided in Figure 5. Abundance and density estimates were dramatically lower in 2013 and 2014, which followed a severe natural food failure in late summer/fall of 2012.

Objective 2: Testing management strategies to reduce bear-human conflicts

During summer 2015 we collected our third year of post-treatment data on the bear-proofing experiment. To ensure that >95% of residences in treatment areas had bear-resistant containers, we surveyed each treatment and control area during early-August to quantify the number and type of containers that were visible from the street (n = 1,341). We found that our efforts to "clean up" treatment areas were a success. Within the northern treatment area 98% of containers were bear-resistant and 2% were regular, and in the southern treatment area 95% were bear-resistant and 5% were regular. We will continue working with the City of Durango to replace regular containers with bear-resistant containers in treatment areas. Within the northern control area 40% of containers were bear-resistant and 60% were regular, and in the southern control area 24% were bear-resistant and 76% were regular. The proportions of bear-resistant containers within control areas have increased over the course of the study as residents have purchased them from the City. For example, when the study was initiated in 2011, only 28% of

residences in the northern control area had bear-resistant containers and only 9% had bear-resistant containers in the southern control area.

Within treatment and control areas we observed 473 instances of bears accessing residential garbage during morning patrols, 115 conflicts in treatment areas and 358 in control areas (Figure 6). Of those conflicts, 47 were in the north treatment area, 103 were in the north control area, 33 were in the south treatment area and 290 were in the south control area. The number of trash-related conflicts in 2015 was higher than during the previous 3 years and peaked in late-August. Of those garbage containers accessed by bears, 76% were regular containers and 24% were bear-resistant containers. Bears accessed human food from bear-resistant containers when they were not properly latched or when trash was stored outside of the cans. We used kernel density functions (Worton 1987) with an h_{ref} value (Gitzen et al. 2006) to spatially estimate the probability of trash-related bear conflicts before and after the distribution of bear resistant containers. We found that since the implementation of the bear-proofing experiment in 2013, trash conflicts have been significantly reduced in the northern experimental unit, and have shifted to the control area in the south experimental unit (Figure 7). While monitoring garbage-related conflicts, we issued 31 notices of violation in treatment areas.

Objective 3: Identifying human behaviors and attitudes related to bear-human encounters

We received a total of 2,432 valid mail survey responses from residents in Durango and La Plata county, which resulted in a 45% survey response rate. Of those surveys, 1,681 residents completed paper surveys and 751 submitted online responses. Survey data is currently being electronically recorded for future analysis.

During summer 2015 we found that the average compliance of residents to wildlife ordinances was 59% in the north treatment area and 35% in the south treatment area. “Compliance” was defined as having a container that was properly locked (both latches clipped) or secured in a garage or shed before 6:00am. Across all sampling periods, compliance was higher in the northern experimental area than in the southern area. In the northern area, compliance increased from 45% in 2013 to 52% in 2014, to 59% in 2015. In the southern area compliance increased from 29% in 2013, to 34% in 2014, to 35% in 2015. When we surveyed residences to assess the proportion of containers that we labeled “non-compliant” (clips unlatched) but were devoid of any trash, we found that 4% met that description in the northern experimental area, and 26% in the southern experimental area (which has alleys). Future estimates of compliance will be corrected based on these numbers.

SUMMARY AND FUTURE PLANS

During FY15-16 we successfully coordinated field logistics and conducted several aspects of data collection (trapping and collaring bears, tracking human-related bear mortalities, collecting bear locations on the urban-wildland interface, assessing summer/fall mast availability, monitoring garbage-related bear-human conflicts, conducting mail surveys, etc.) and initiated demographic analyses. Data collection will continue through winter 2017, and we will continue to analyze data and prepare research publications. In the coming year, we will be finalizing demographic estimates from the non-invasive genetic mark-recapture data, and developing integrated population models which can be used to better track trends in bear population dynamics. In addition, we will be identifying factors affecting driving tolerance for black bears, compliance behaviors related to bear-proofing, and the effects of bear-proofing efforts on risk of conflict with bears. Once data collection is complete, we will then be able to conduct the remainder of the analyses needed to meet project goals. By addressing our research objectives we hope to better understand the influence of urban environments on bear populations, elucidate the relationship between bear-human conflicts and bear behavior and demography, understand the effect of bear-human interactions on human attitudes and actions, develop tools to promote the sustainable management of bears in Colorado, and ultimately, identify solutions for reducing bear-human conflicts in urban environments.

LITERATURE CITED

Baruch-Mordo, S., S.W. Breck, K.R. Wilson, and J. Broderick. 2011. The carrot or the stick? Evaluation of education and enforcement as management tools for human-wildlife conflicts. PLoS One 6: e15681.

Baruch-Mordo, S., S.W. Breck, K.R. Wilson, and D.M. Theobald. 2008. Spatiotemporal distribution of black bear-human conflicts in Colorado, USA. Journal of Wildlife Management 72:1853-1862.

Baruch-Mordo, S., K.R. Wilson, D. Lewis, J. Broderick, J. Mao, and S.W. Breck. 2010. Roaring Fork Valley urban black bear ecology study: progress report to the Colorado Division of Wildlife. Contact Sharon Baruch-Mordo for copy. Email: sharonb_m@yahoo.com

Beck, T.D.I. 1991. Black bears of west-central Colorado. Technical Publication No. 39, Colorado Division of Wildlife, Colorado.

Beckmann, J.P., and J. Berger. 2003a. Using black bears to test ideal-free distribution models experimentally. Journal of Mammalogy 84:594-606.

Beckmann, J.P., and J. Berger. 2003b. Rapid ecological and behavioural changes in carnivores: the response of black bears (*Ursus americanus*) to altered food. Journal of Zoology 261:207-212.

Beckmann, J.P., L. Karasin, C. Costello, S. Matthews, and Zoë Smith. 2008. Coexisting with black bears: perspectives from four case studies across North America. Wildlife Conservation Society Working Paper No 33.

Beckmann, J.P., C.W. Lackey, and J. Berger. 2004. Evaluation of deterrent techniques and dogs to alter behavior of "nuisance" black bears. Wildlife Society Bulletin 32: 1141-1146.

Beston, J.A. 2011. Variation in life history and demography of the American black bear. Journal of Wildlife Management 75:1588-1596.

Boyce, M.S., P.R. Vernier, S.E. Nielsen, and F.K.A. Schmiegelow. 2002. Evaluating resource selection functions. Ecological Modelling 157:281-300.

Burnham, K.P., and D.R. Anderson. 2002. Model selection and multimodel inference: a practical information-theoretic approach. Second Edition, Springer, New York, New York.

Carter, N.H., D.G. Brown, D.R. Etter, and L.G. Visser. 2010. American black bear habitat selection in northern Lower Peninsula, Michigan, USA, using discrete-choice modeling. Ursus 21:57-71.

Caswell, H. 2001. Matrix population models: construction, analysis, and interpretation. Second Edition, Sinauer Associates, Sunderland, Massachussetts.

Clevenger, A.P., J. Wierzchowski, B. Chruszcz, and K. Gunson. 2002. GIS-generated, expert-based models for identifying wildlife habitat linkages and planning mitigation passages. Conservation Biology 16:503-514.

Garshelis, D.L., and H. Hristienko. 2006. State and provincial estimates of American black bear numbers versus agency assessments of population trend. Ursus 17:1-7.

Gillies, C.S., M. Hebblewhite, S.E. Nielsen, M.A. Krawchuk, C.L. Aldridge, J.L. Frair, D.J. Saher, C.E. Stevens, and C.L. Jerde. 2006. Application of random effects to the study of resource selection by animals. Journal of Animal Ecology 75:887-898.

Gitzen, R.A., J.J. Millspaugh, and B.J. Kernohan. 2006. Bandwidth selection for fixed-kernal analysis of animal utilization distributions. Journal of Wildlife Management 70:1334-1344.

Gore, M.L., W.F. Siemer, J.E. Shanahan, D. Schuefele, and D.J. Decker. 2005. Effects on risk perception of media coverage of a black bear-related human fatality. Wildlife Society Bulletin 33:507-516.

Gore, M.L., B.A. Knuth, C.W. Scherer, and P.D. Curtis. 2008. Evaluating a conservation investment designed to reduce human-wildlife conflicts. Conservation Letters 1:136–145.

Greenleaf, S.S., S.M. Matthews, R.G. Wright, J.J. Beecham, and H.M. Leithead. 2009. Food habitat of American black bears as a metric for direct management of human-bear conflict in Yosemite Valley, Yosemite National Park, California. Ursus 20:94-101.

Hebblewhite, M., and E. Merrill. 2008. Modelling wildlife – human relationships for social species with mixed-effects resource selection models. Journal of Applied Ecology 45:834-844.

Hostetler, J.A., J.W. McCown, E.P. Garrison, A.M Neils, M.A. Barrett, M.E. Sunquist, S.L. Simek, and

M.K. Oli. 2009. Demographic consequences of anthropogenic influences: Florida black bears in north-central Florida. Biological Conservation 142:2456-2463.
Hristienko, H., and J.E. McDonald Jr. 2007. Going into the 21st century: a perspective on trends and controversies in the management of the American black bear. Ursus 18:72-88.
Johnson, D.H. 1980. The comparison of usage and availability measurements for evaluating resource preference. Ecology 61:65-71.
Johnson, H.E, C.J. Bishop, M.W. Alldredge, J. Brodrick, J. Apker, S. Breck, K. Wilson, and J. Beckmann. 2011. Black bear exploitation of urban environments: finding management solutions and assessing regional population effects. Research Proposal, Colorado Division of Parks and Wildlife, Fort Collins, USA.
Johnson, H.E. 2012. Black bear exploitation of urban environments: finding management solutions and assessing regional population effects. Federal Aid Annual Report, Colorado Division of Parks and Wildlife, Fort Collins, USA.
Johnson, H.E., S.A. Lischka, J. Broderick, J. Apker, S. Breck, J. Beckmann, K. Wilson, and P. Dorsey. 2014. Black bear exploitation of urban environments: finding management solutions and assessing regional population effects. Federal Aid Annual Report, Colorado Parks and Wildlife, Fort Collins, USA.
Johnson, H.E., S.W. Breck, S. Baruch-Mordo, D.L. Lewis, C.W. Lackey, K.R. Wilson, J. Broderick, J.S. Mao, and J.P. Beckmann. 2015. Shifting perceptions of risk and reward: dynamic selection for human development by black bears in the western United States. Biological Conservation 187:164-172.
Manly, B.F.J., L.L. McDonald, D.L. Thomas, T.L. McDonald, and W.P. Erickson. 2002. Resource selection by animals; statistical design and analysis for field studies. Second Edition. Kluwer Academic Publishers, Boston, Massachussetts.
McLoughlin, P.D., D.W. Morris, D. Fortin, E. Vander Wal, and A.L. Contasti. 2010. Considering ecological dynamics in resource selection functions. Journal of Animal Ecology 79:4-12.
Mitchell, M.S., L.B. Pacifici, J.B. Grand, and R.A. Powell. 2009. Contributions of vital rates to growth of a protected population of American black bears. Ursus 20:77-84.
Morales, J.M., P.R. Moorcroft, J. Matthiopoulos, J.L. Frair, J.G. Kie, R.A. Powell, E.H. Merrill, and D.T. Haydon. 2010. Building the bridge between animal movement and population dynamics. Philosophical Transactions of the Royal Society Series B 365:2289-2301.
Mowat, G., and C. Strobeck. 2000. Estimating population size of grizzly bears using hair capture, DNA profiling, and mark-recapture analysis. Journal of Wildlife Management 64:183-193.
Noyce, K.V., and P.L. Coy. 1989. Abundance and productivity of bear food species in different forest types of northcentral Minnesota. International Conference on Bear Research and Management 8:169-181.
Peine, J.D. 2001. Nuisance bears in communities: Strategies to reduce conflicts. Human Dimensions of Wildlife 6:223-237.
Royle, J.A., R.B. Chandler, C.C. Sun, and A.K. Fuller. 2013. Integrating resource selection information with spatial capture-recapture. Methods in Ecology and Evolution 4:520-530.
Sadeghpour, M.H., and T.F. Ginnett. 2011. Habitat selection by female American black bears in northern Wisconsin. Ursus 22:159-166.
Spencer, R.D., R.A. Beausoleil, and D.A. Martorello. 2007. How agencies respond to human–bear conflicts: a survey of wildlife species in North America. Ursus 18: 217–229.
Theobald, D.M., and W.H. Romme. 2007. Expansion of the US wildland-urban interface. Landscape and Urban Planning 83:340-354.
Wagner, T., D.R. Diefenbach, S.A. Christensen, and A.S. Norton. 2011. Using multilevel models to quantify heterogeneity in resource selection. Journal of Wildlife Management 75:1788-1796.
Wolfe, L.L., H.E. Johnson, M.C. Fisher, M.A. Sirochman, B. Kraft, and M.W. Miller. 2014. Use of

Acepromazine and Medetomidine in combination for sedation and handling of Rocky Mountain elk (*Cervus elaphus nelsoni*) and black bears (*Ursus americanus*). Journal of Wildlife Diseases 50:979-981.

Woods, J.G., D. Paetkau, D. Lewis, B.N. McLellan, M. Proctor, and C. Strobeck. 1999. Genetic tagging of free-ranging black and brown bears. Wildlife Society Bulletin 27:616-627.

Worton, B.J. 1987. A review of models of home range for animal movement. Ecological Modelling 38:277-298.

Zack, C.S., B.T. Milne, and W.C. Dunn. 2003. Southern oscillation index as an indicator of encounters between humans and black bears in New Mexico. Wildlife Society Bulletin 31:517-520.

Prepared by_____

Heather E. Johnson, Wildlife Researcher

Table 1. Capture information for black bears that were newly marked in the vicinity of Durango, CO during summer 2015 and winter 2016 (collared adult females are identified with an "*"). Only information from the initial capture of each individual is shown (no recaptures).

Bear ID	Capture Date	UMT Easting	UTM Northing	Sex	Estimated Age	Weight (kg)
B470	7/15/2015	243847	4122598	M	3	74.8
B469	7/21/2015	243861	4122743	M	12	199.6
B471	7/28/2015	243861	4122743	M	2	40.4
B472	8/4/2015	244219	4122743	M	3	64.0
B473	8/10/2015	242544	4128370	M	2	52.6
B474	8/19/2015	246530	4135648	M	5	97.1
B475	8/21/2015	239245	4128553	M	8	119.7
B476	8/22/2015	239992	4128359	M	10	122.5
B477	8/25/2015	246530	4135648	M	10	152.4
B478	8/27/2015	246530	4135648	M	1	35.8
B479	8/27/2015	243944	4134850	M	2	56.7
B480*	8/28/2015	238871	4126931	F	5	60.8
B481*	8/29/2015	246530	4135648	F	8	78.9
B482	8/31/2015	244608	4125554	M	4	74.8
B483*	8/31/2015	242766	4133049	F	4	61.2
B484	9/2/2015	238209	4130562	M	10	131.1
B485	9/3/2015	239245	4128553	M	1	46.7
B486	9/3/2015	244608	4125554	M	1	42.6
B487	9/9/2015	249044	4131886	M	1	34.0
B488	9/10/2015	243215	4128740	M	2	43.1
B489	9/11/2015	249035	4131895	M	3	62.1
B490	9/11/2015	249065	4133012	M	1	41.3
B491*	9/12/2015	248536	4139267	F	6	80.7
B492*	9/14/2015	248536	4139267	F	12	73.5
B493	9/16/2015	248536	4139267	M	10	137.9
B514	1/28/2016	240613	4125119	M	1	40.8
B515	1/28/2016	240613	4125119	F	1	36.3
B531	2/18/2016	239003	4137869	M	1	30.8
B547	3/15/2016	236722	4133888	F	1	11.8
B532	3/1/2016	236340	4132122	M	cub	1.1
B533	3/1/2016	236340	4132122	F	cub	1.2
B534	3/1/2016	236340	4132122	F	cub	1.2
B535	3/3/2016	252235	4138922	F	cub	2.3
B536	3/3/2016	252235	4138922	M	cub	2.4
B537	3/4/2016	256994	4140745	F	cub	0.8
B538	3/7/2016	248987	4140248	M	cub	1.6
B539	3/8/2016	249773	4129514	M	cub	3.2
B540	3/10/2016	240429	4104602	M	cub	2.3
B541	3/10/2016	240429	4104602	M	cub	1.9
B542	3/10/2016	240429	4104602	M	cub	2.4
B543	3/11/2016	247170	4134166	M	cub	2.2
B544	3/11/2016	247170	4134166	M	cub	2.5
B545	3/14/206	257188	4134879	F	cub	2.9
B546	3/14/2016	257188	4134879	F	cub	2.8

B548	3/16/2016	245703	4141023	M	cub	1.8
B549	3/16/2016	245703	4141023	M	cub	1.8
B550	3/17/2016	252210	4132171	F	cub	2.9
B551	3/17/2016	252210	4132171	F	cub	2.3
B552	3/17/2016	252210	4132171	M	cub	2.3
B553	3/18/2016	235030	4150681	F	cub	1.6
B554	3/18/2016	235030	4150681	M	cub	1.8
B555	3/19/2016	763412	4133906	M	cub	2.9
B556	3/19/2016	763412	4133906	M	cub	2.9
B557	3/19/2016	763412	4133906	F	cub	2.6

Figure 1. Number of weekly black bear captures from May 15th through September 15th during the 2011 through 2015 summer trapping seasons. Note: trapping did not commence until July in 2014 and 2015.

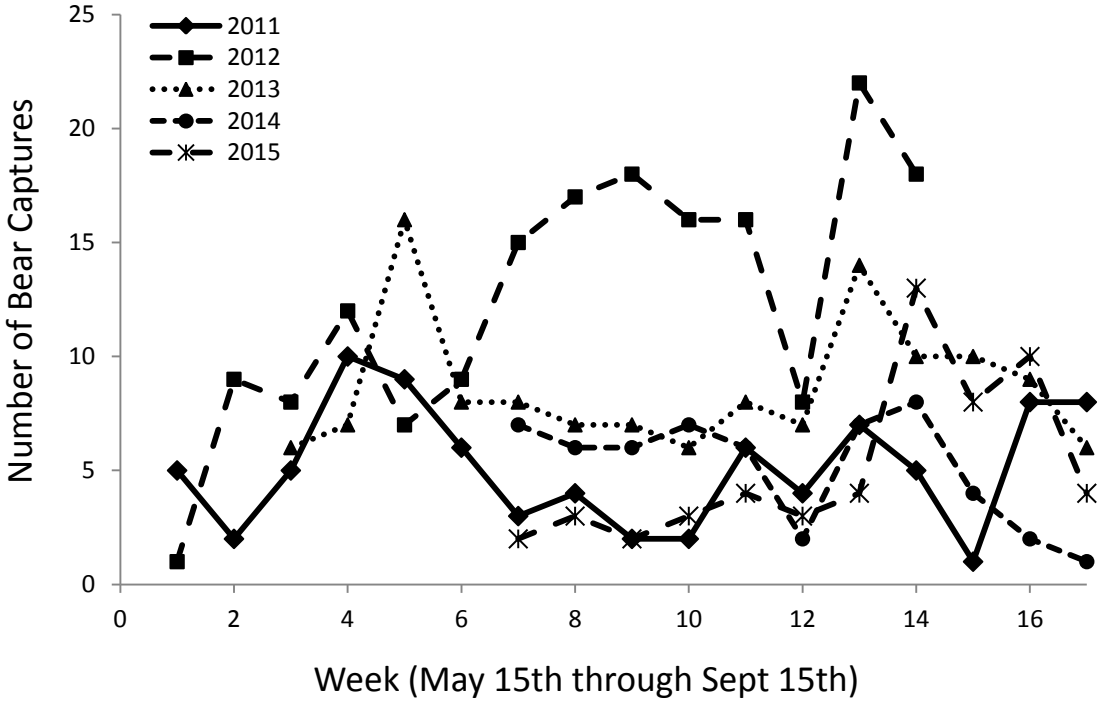


Figure 2. GPS collar locations from 46 adult female black bears collected during 1 January – 31 December 2015 in the vicinity of Durango, Colorado (different colored clusters of points represent different individual bears).

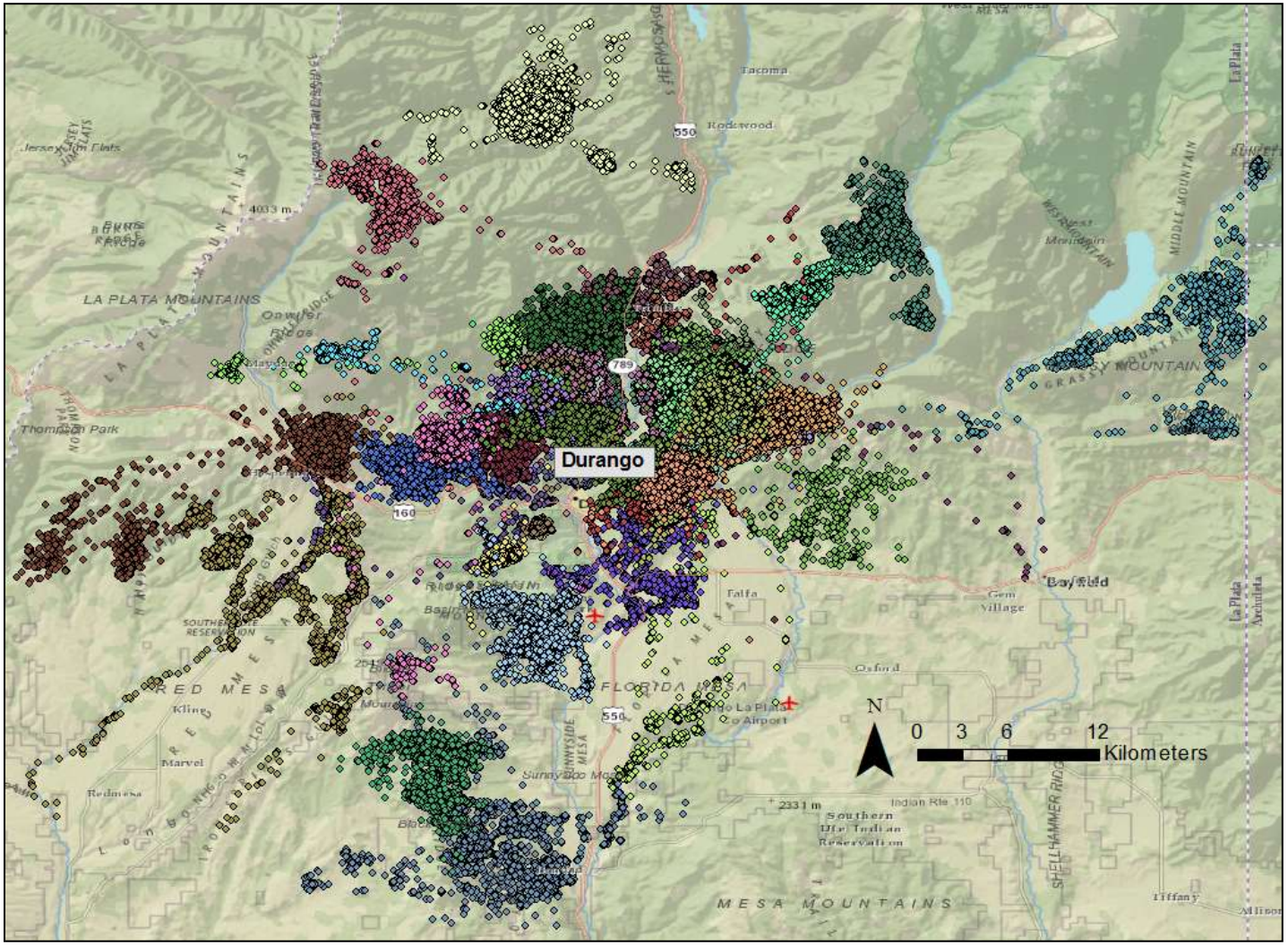


Figure 3. Mean abundance of soft and hard mast observed on vegetation transects from 2011-2015. Mast species included gamble oak, chokecherry, serviceberry, native crabapple and pinyon pine. Abundance reflects the proportion of plants observed with mast.

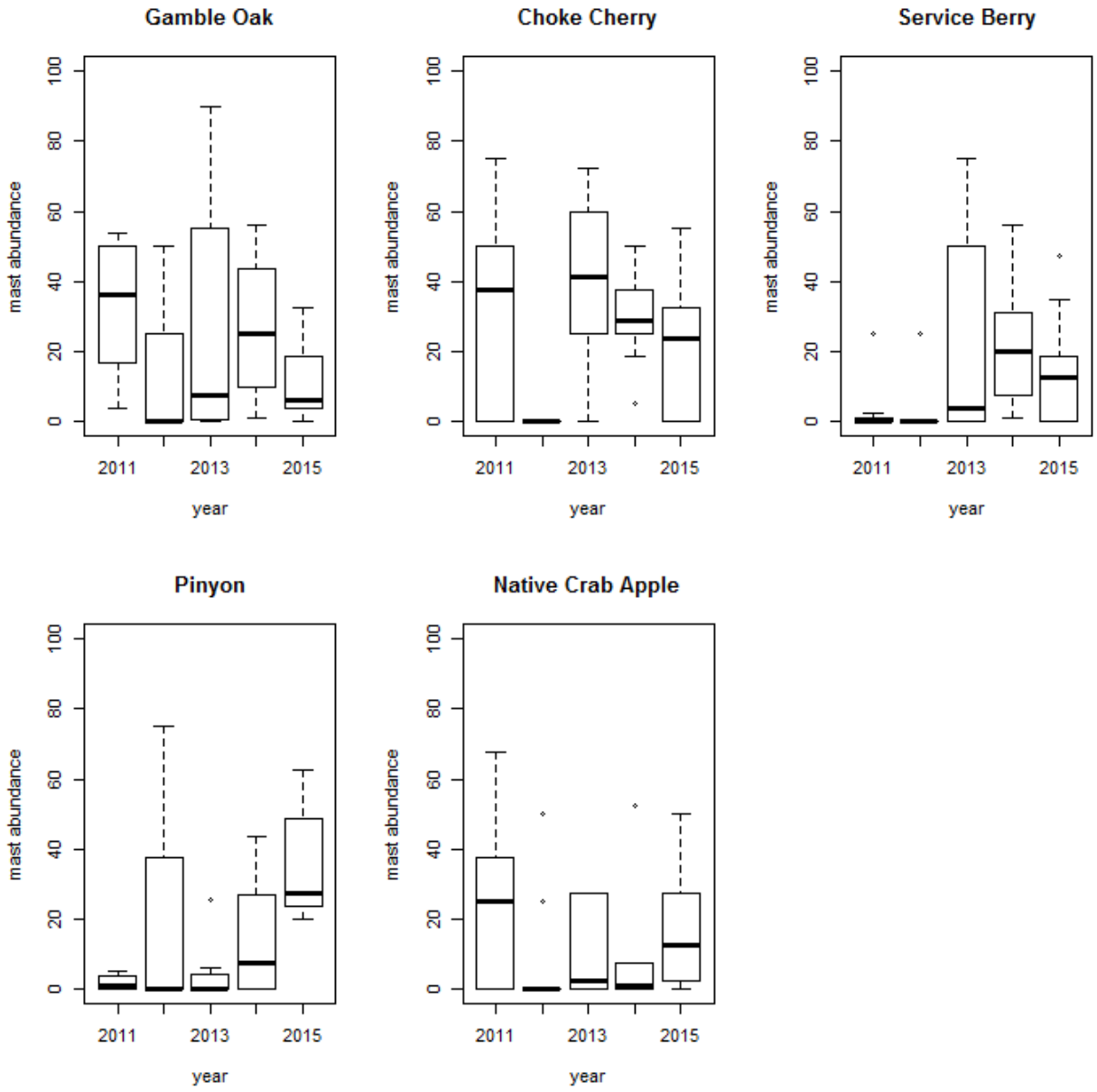


Figure 4. Model averaged density estimates based on integrated spatially-explicit capture-mark-recapture models (solid lines; using both hair-snare and GPS collar data) and standard spatially-explicit capture-mark-recapture models (dashed lines; using hair-snare data only) for female black bears near Durango, Colorado, USA from 2011 to 2014.

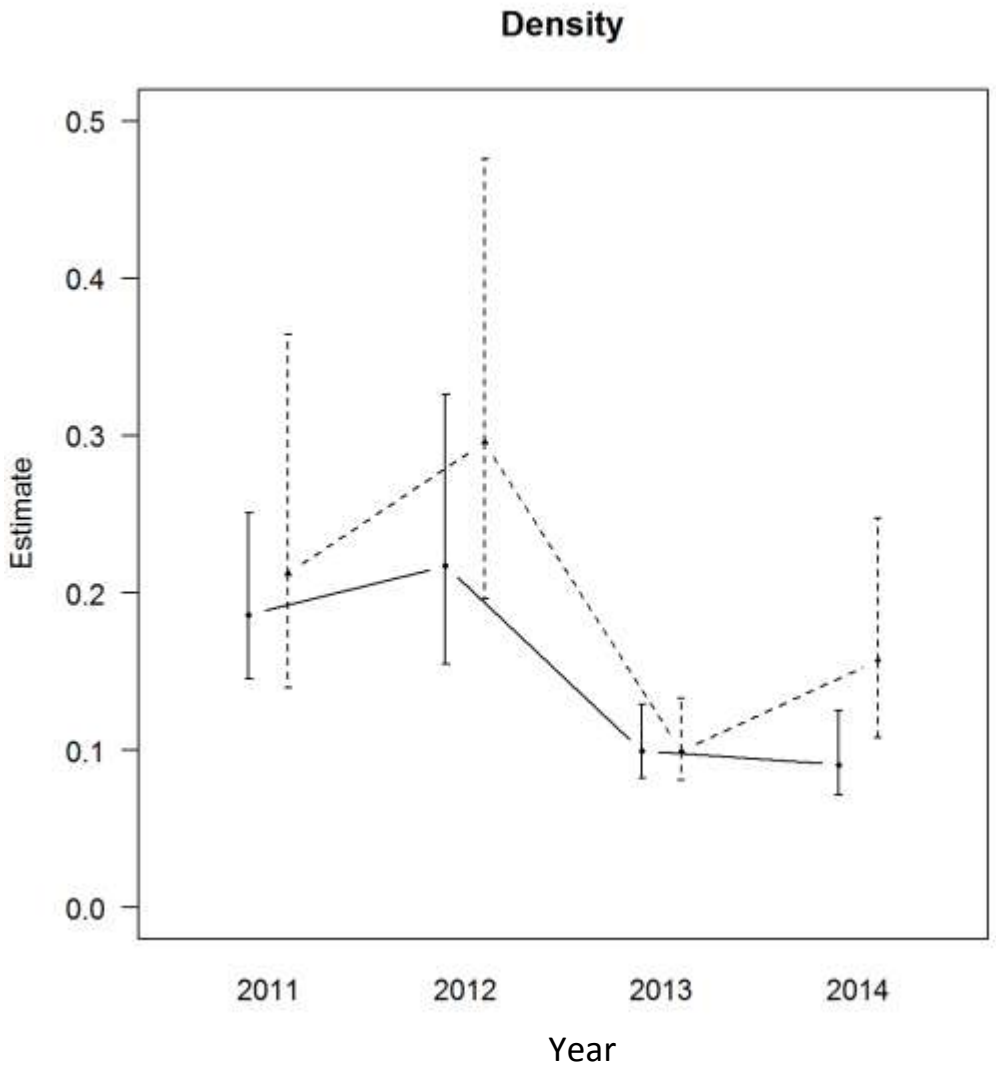


Figure 5. Predicted density surfaces for female black bears/km^2 near Durango, Colorado, USA from 2011 to 2014. Surfaces were derived from year-specific model-averaged estimates.

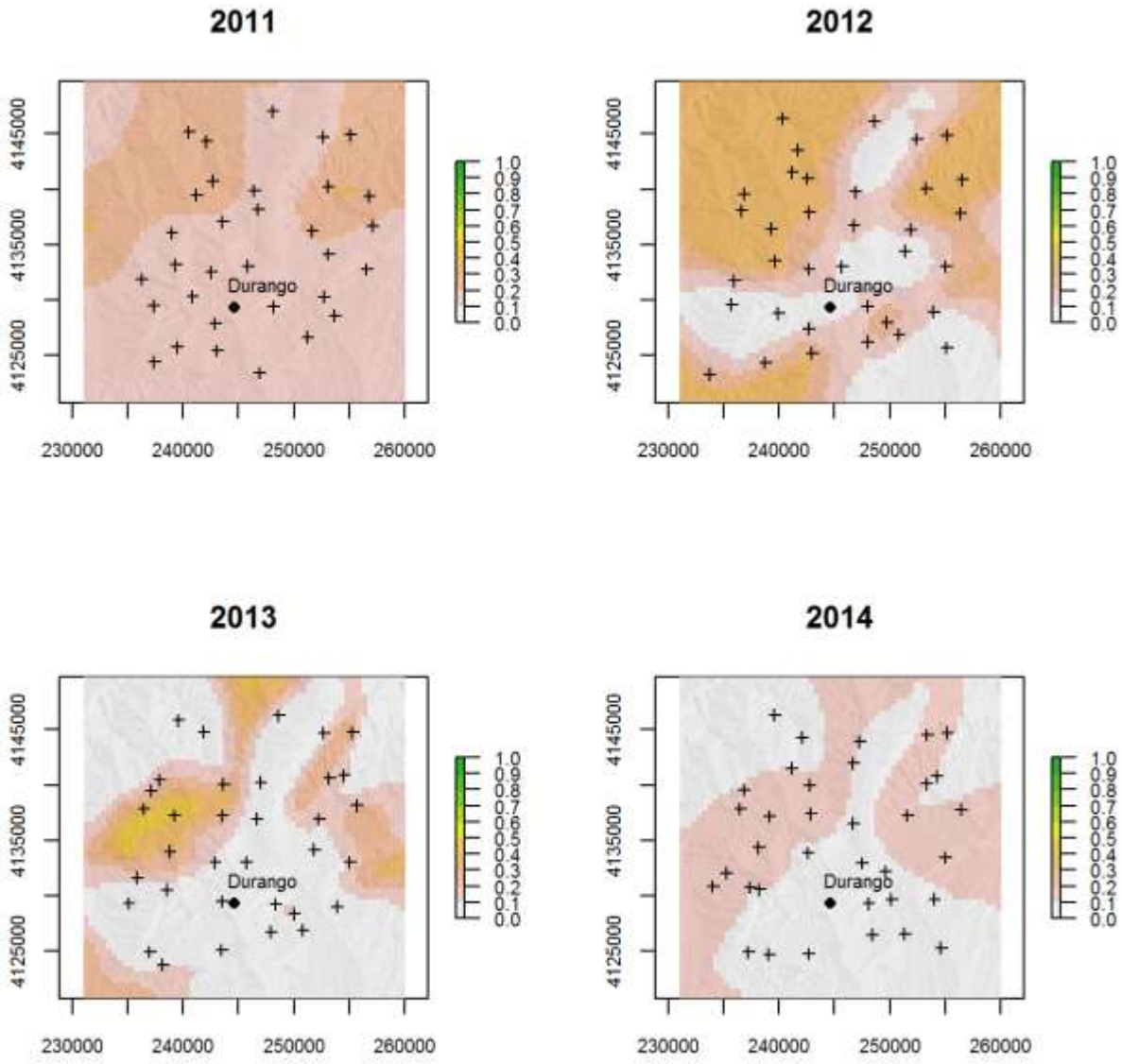


Figure 6. Garbage-related black bear-human conflicts observed during July through September 2015. Red lines indicate treatment areas and black lines indicate control areas. Green circles represent conflicts with

regular residential garbage containers and purple circles represent conflicts with wildlife-resistant containers.

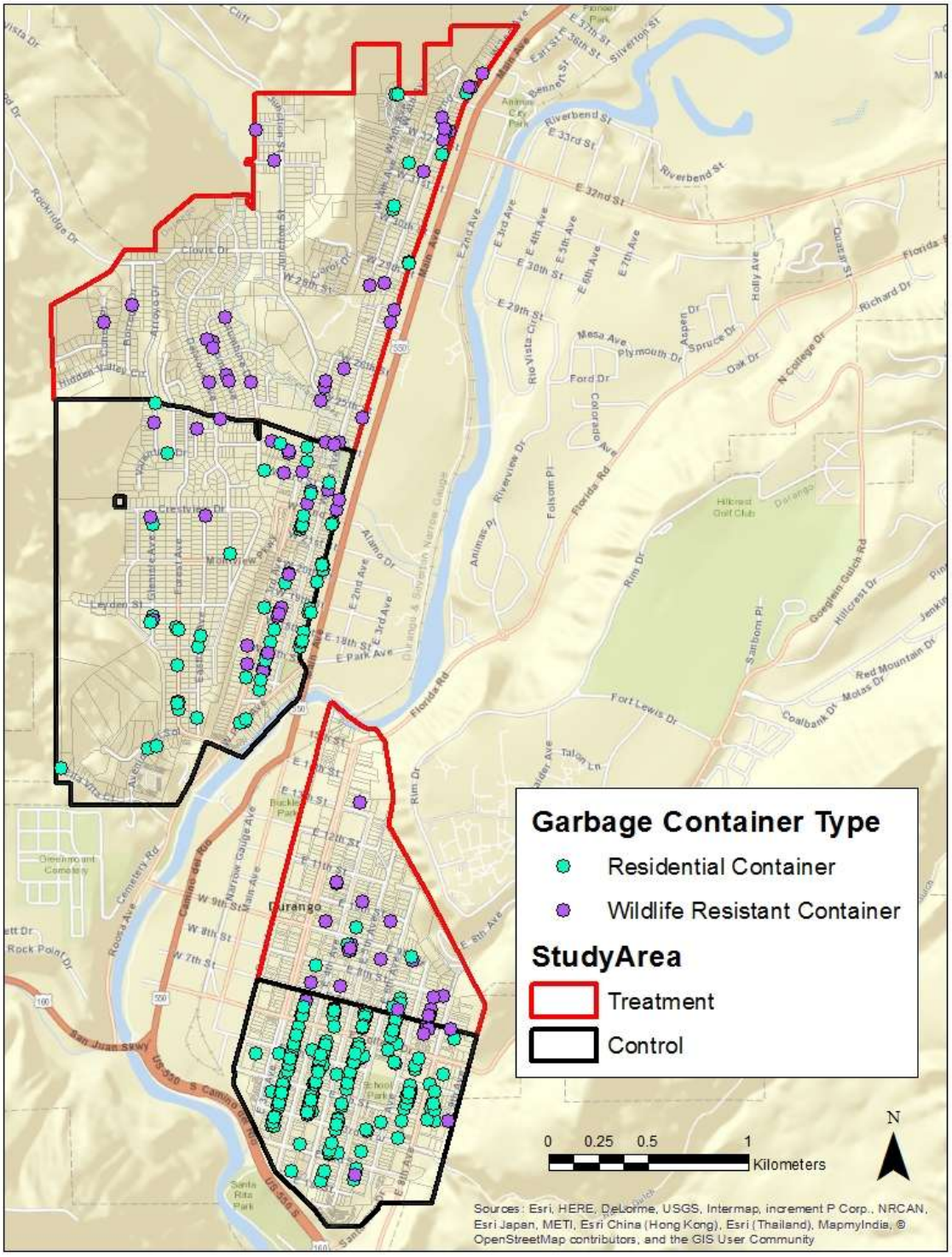
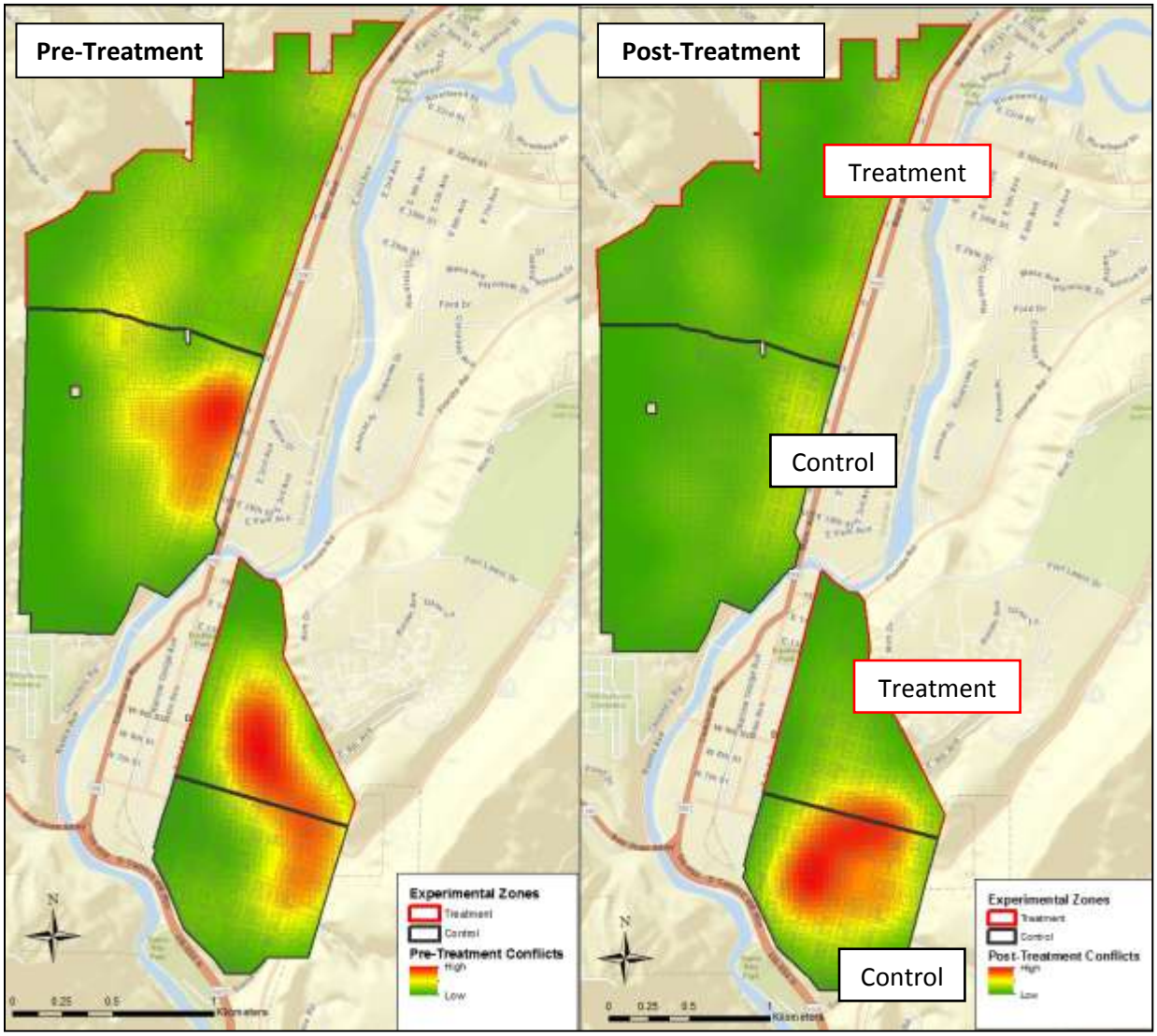


Figure 7. 'Hot spots' of black-bear human trash conflicts pre- and post-distribution of bear-resistant trash containers in Durango, Colorado. All residents in treatment areas (outlined in red) were given bear-resistant trash containers in 2013; residents in the control areas (outlined in black) did not receive bear-

resistant containers. Pre-treatment data were collected 2011-2012, and post-treatment data were collected 2013-2015. Hot spots were identified as those areas with the highest probabilites of conflict from kernal density functions of all observed trash conflicts.



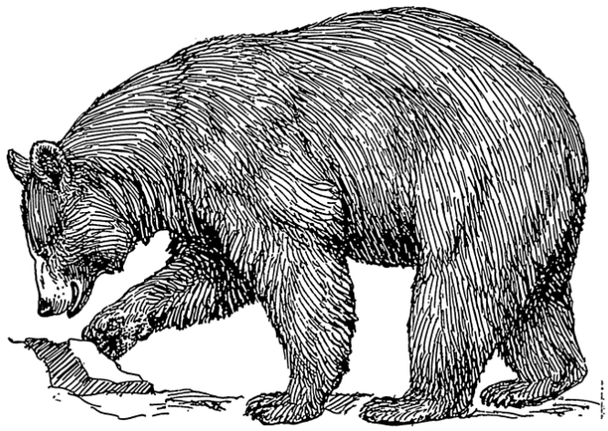
COLORADO PARKS & WILDLIFE

1313 Sherman • Denver, Colorado 80203
Phone (303) 866-3203 cpw.state.co.us

Colorado State University

Living with Black Bears in Durango:

A survey of your views



THANK YOU FOR YOUR COOPERATION!
All of your responses will be kept confidential.
Please return this survey in the postage-paid return envelope provided.

Living with Black Bears in Durango

This questionnaire is part of a study, conducted by Colorado Parks and Wildlife and Colorado State University, to learn what you think about living with bears in Durango. You may have completed a survey similar to this in 2012 or 2014. Please take a few minutes to complete this questionnaire, even if you completed an earlier survey or do not have strong opinions about bears. It is important we hear from all Durangoans. Please return the completed questionnaire in the postage-paid envelope provided **no later than April 1, 2016**. The survey should take about 20 minutes to complete.

THANK YOU FOR YOUR ASSISTANCE!

Your General Thoughts about Black Bears. The following questions will help us understand how you think about black bears in general.

1. How important is it to you to know that bears live in this area and will continue to do so in the future? *(Please circle only one.)*

Very important		Somewhat important		Not at all important	I am not sure.
1	2	3	4	5	6

2. To what extent are you concerned about negative interactions between black bears and people in the area where you live? *(Please circle only one.)*

Very concerned		Somewhat concerned		Not at all concerned	I am not sure.
1	2	3	4	5	6

3. Overall, how would you rate management of black bears in the area where you live? *(Please circle only one.)*

Excellent	Above average	Average	Below average	Poor	I am not sure.
1	2	3	4	5	6

4. Overall, how would you rate management of bear-human interactions in the area where you live? *(Please circle only one.)*

Excellent	Above average	Average	Below average	Poor	I am not sure.
1	2	3	4	5	6

5. Based on your experience, how has the number of black bears in the area where you live changed over the **past 2 years**? *(Please circle only one.)*

Increased greatly		Stayed the same		Decreased greatly	I am not sure.
1	2	3	4	5	6

6. How would you like to see the number of black bears in the area where you live change in the **next 2 years**? *(Please circle only one.)*

Increase greatly		Stay the same		Decrease greatly	I am not sure.
1	2	3	4	5	6

7. How important is it to you that the change in black bear numbers you indicated in Question 6 occur over the **next 2 years**? *(Please circle only one.)*

Very important		Somewhat important		Not at all important	I am not sure.
1	2	3	4	5	6

8. Below are several general statements about the risks and benefits of black bears in this area. Please check the box that best describes your level of agreement with each statement.

	Strongly disagree		**Neither**		**Strongly agree**	**I am not sure.**
a. The presence of black bears improves quality of life for people living in and around Durango.	[ ]1	[ ]2	[ ]3	[ ]4	[ ]5	[ ]6
b. Black bears provide recreational opportunities for many Durango-area residents.	[ ]1	[ ]2	[ ]3	[ ]4	[ ]5	[ ]6
c. Black bears improve the health of the environment in the Durango area.	[ ]1	[ ]2	[ ]3	[ ]4	[ ]5	[ ]6
d. Black bears living in this area are an inconvenience.	[ ]1	[ ]2	[ ]3	[ ]4	[ ]5	[ ]6
e. Black bears will be more of a problem for Durango in the future.	[ ]1	[ ]2	[ ]3	[ ]4	[ ]5	[ ]6
f. I am not familiar with the risks posed by black bears.	[ ]1	[ ]2	[ ]3	[ ]4	[ ]5	[ ]6
g. I am vulnerable to the risks posed by black bears.	[ ]1	[ ]2	[ ]3	[ ]4	[ ]5	[ ]6
h. I can prevent conflicts with black bears by making changes around my home.	[ ]1	[ ]2	[ ]3	[ ]4	[ ]5	[ ]6
i. Conflict with black bears will be reduced if people learn to live with bears.	[ ]1	[ ]2	[ ]3	[ ]4	[ ]5	[ ]6
j. Encounters with black bears are likely to result in serious injuries or human deaths.	[ ]1	[ ]2	[ ]3	[ ]4	[ ]5	[ ]6
k. I fear having an encounter with black bears.	[ ]1	[ ]2	[ ]3	[ ]4	[ ]5	[ ]6

Your Experiences with Black Bears. Durangoans come into contact with black bears in many ways, and these interactions mean different things to each person. Please tell us about your interactions with black bears and what they mean to you.

9. How often have you experienced the following interactions with black bears in the **past 2 years** in the area where you live? *(Please check one for each item.)*

	0 times	1-2 times	3-4 times	5 or more times	I am not sure.
a. Saw black bears in the wild, on open space or public land	[ ]1	[ ]2	[ ]3	[ ]4	[ ]5
b. Saw black bears in urban or suburban areas of town	[ ]1	[ ]2	[ ]3	[ ]4	[ ]5
c. Saw black bears near my home	[ ]1	[ ]2	[ ]3	[ ]4	[ ]5
d. Had a black bear break into or attempt to break into my garbage	[ ]1	[ ]2	[ ]3	[ ]4	[ ]5
e. Had a black bear get into or damage my fruit trees or garden	[ ]1	[ ]2	[ ]3	[ ]4	[ ]5
f. Had a black bear get into or damage my bird feeder, pet feeder, or grill	[ ]1	[ ]2	[ ]3	[ ]4	[ ]5
g. Had a black bear damage other property (e.g. fences, car, garage)	[ ]1	[ ]2	[ ]3	[ ]4	[ ]5
h. Had a black bear harass or attack my pets	[ ]1	[ ]2	[ ]3	[ ]4	[ ]5
i. Had a black bear harass or attack my livestock	[ ]1	[ ]2	[ ]3	[ ]4	[ ]5
j. Had a black bear enter or attempt to enter my home	[ ]1	[ ]2	[ ]3	[ ]4	[ ]5
k. Knew someone who was harassed by a black bear	[ ]1	[ ]2	[ ]3	[ ]4	[ ]5
l. Knew someone who was attacked by a black bear	[ ]1	[ ]2	[ ]3	[ ]4	[ ]5
m. Was harassed or felt threatened by a black bear myself	[ ]1	[ ]2	[ ]3	[ ]4	[ ]5
n. Was attacked by a black bear myself	[ ]1	[ ]2	[ ]3	[ ]4	[ ]5

10. How acceptable do you find the risk that you will experience the following interactions with bears in the **next 2 years**? *(Please check one for each item.)*

	Very acceptable	Somewhat acceptable	Neither acceptable, nor unacceptable	Somewhat unacceptable	Very unacceptable	I am not sure.
a. See black bears in the wild, on open space or public land	[ ]1	[ ]2	[ ]3	[ ]4	[ ]5	[ ]6
b. See black bears in urban or suburban areas of town	[ ]1	[ ]2	[ ]3	[ ]4	[ ]5	[ ]6
c. See black bears near my home	[ ]1	[ ]2	[ ]3	[ ]4	[ ]5	[ ]6
d. Have a black bear break into or attempt to break into my garbage	[ ]1	[ ]2	[ ]3	[ ]4	[ ]5	[ ]6
e. Have a black bear get into or damage my fruit trees or garden	[ ]1	[ ]2	[ ]3	[ ]4	[ ]5	[ ]6
f. Have a black bear get into or damage my bird feeder, pet feeder, or grill	[ ]1	[ ]2	[ ]3	[ ]4	[ ]5	[ ]6
g. Have a black bear damage other property (e.g. fences, car, garage, etc.)	[ ]1	[ ]2	[ ]3	[ ]4	[ ]5	[ ]6
h. Have a black bear harass or attack my pets	[ ]1	[ ]2	[ ]3	[ ]4	[ ]5	[ ]6
i. Have a black bear harass or attack my livestock	[ ]1	[ ]2	[ ]3	[ ]4	[ ]5	[ ]6
j. Had a black bear enter or attempt to enter my home	[ ]1	[ ]2	[ ]3	[ ]4	[ ]5	[ ]6
k. Know someone who was harassed by a black bear	[ ]1	[ ]2	[ ]3	[ ]4	[ ]5	[ ]6
l. Know someone who was attacked by a black bear	[ ]1	[ ]2	[ ]3	[ ]4	[ ]5	[ ]6
m. Be harassed or felt threatened by a black bear myself	[ ]1	[ ]2	[ ]3	[ ]4	[ ]5	[ ]6
n. Be attacked by a black bear myself	[ ]1	[ ]2	[ ]3	[ ]4	[ ]5	[ ]6

11. What is the likelihood that you will experience the following interactions with black bears in the **next 2 years** in the area where you live? *(Please check one for each item.)*

	Very likely	Somewhat likely	Neither likely, nor unlikely	Somewhat unlikely	Very unlikely	I am not sure.
a. See black bears in the wild, on open space or public land	[ ]1	[ ]2	[ ]3	[ ]4	[ ]5	[ ]6
b. See black bears in urban or suburban areas of town	[ ]1	[ ]2	[ ]3	[ ]4	[ ]5	[ ]6
c. See black bears near my home	[ ]1	[ ]2	[ ]3	[ ]4	[ ]5	[ ]6
d. Have a black bear break into or attempt to break into my garbage	[ ]1	[ ]2	[ ]3	[ ]4	[ ]5	[ ]6
e. Have a black bear eat from or damage my fruit trees or garden	[ ]1	[ ]2	[ ]3	[ ]4	[ ]5	[ ]6
f. Have a black bear eat from or damage my bird feeder, pet feeder, or grill	[ ]1	[ ]2	[ ]3	[ ]4	[ ]5	[ ]6
g. Have a black bear damage other property (e.g. fences, car, garage, etc.)	[ ]1	[ ]2	[ ]3	[ ]4	[ ]5	[ ]6
h. Have a black bear harass or attack my pets	[ ]1	[ ]2	[ ]3	[ ]4	[ ]5	[ ]6
i. Have a black bear harass or attack my livestock	[ ]1	[ ]2	[ ]3	[ ]4	[ ]5	[ ]6
j. Have a black bear enter or attempt to enter my home	[ ]1	[ ]2	[ ]3	[ ]4	[ ]5	[ ]6
k. Know someone who was harassed by a black bear	[ ]1	[ ]2	[ ]3	[ ]4	[ ]5	[ ]6
l. Know someone who was attacked by a black bear	[ ]1	[ ]2	[ ]3	[ ]4	[ ]5	[ ]6
m. Be harassed or feel threatened by a black bear myself	[ ]1	[ ]2	[ ]3	[ ]4	[ ]5	[ ]6
n. Be attacked by a black bear myself	[ ]1	[ ]2	[ ]3	[ ]4	[ ]5	[ ]6

Addressing Human-Black Bear Interactions. Please tell us about what you do to address black bear-human interactions in your life and why you choose to take those actions.

12. In the **past 2 years,** have you taken any of the following actions to minimize your risk of negative interactions with black bears where you live? *(Please check one for each item.)*

	Yes	No		Yes	No
a. Use a wildlife-resistant garbage container or dumpster	[ ]1	[ ]2	**d.** Remove bird, squirrel and other wildlife feeders	[ ]1	[ ]2
b. Keep garbage secured until the morning of pickup day, rather than putting it out the night before	[ ]1	[ ]2	**e.** Keep the doors and windows of my house and car closed	[ ]1	[ ]2
c. Feed my pets indoors	[ ]1	[ ]2	**f.** Keep my pets indoors	[ ]1	[ ]2
d. Not having composters, gardens or fruit trees	[ ]1	[ ]2	**g.** Other (*Please indicate.* _____)	[ ]1	[ ]2

13. In the **past 2 years**, have you ***observed others in your neighborhood*** taking these actions to minimize their risk of interactions with bears? *(Please check one for each item.)*

	Yes	No		Yes	No
a. Using a wildlife-resistant garbage container or dumpster	[ ]1	[ ]2	**d.** Removing bird, squirrel and other wildlife feeders	[ ]1	[ ]2
b. Keeping garbage secured until the morning of pickup day, rather than putting it out the night before	[ ]1	[ ]2	**e.** Keeping the doors and windows of their houses and cars closed	[ ]1	[ ]2
c. Feeding pets indoors	[ ]1	[ ]2	**f.** Keeping pets indoors	[ ]1	[ ]2
d. Not having composters, gardens or fruit trees	[ ]1	[ ]2	**g.** Other (*Please indicate.* _____)	[ ]1	[ ]2

14. Did you report negative interactions with bears you've experienced in the past 2 years to any authorities? Please leave this question blank if you haven't experienced any negative interactions in the past 2 years. *(Please check one.)*

[ ]1 Yes [ ]2 No ***Please skip to question 16.***

15. To whom did you report your negative interactions with black bears in or around Durango? *(Please check all that apply.)*

[ ]1 Durango police department or LaPlata County sherriff's department
[ ]2 City of Durango
[ ]3 Colorado Parks and Wildlife
[ ]4 Bearsmart Durango
[ ]5 USDA Wildlife Services

16. How effective do you believe the following actions can be in minimizing the risk of negative interactions with black bears? *(Please check one for each item.)*

	Very effective	Somewhat effective	Neither effective, nor ineffective	Somewhat ineffective	Very ineffective	I am not sure.
a. Using a wildlife-resistant garbage container or dumpster	[ ]1	[ ]2	[ ]3	[ ]4	[ ]5	[ ]6
b. Keeping garbage secured until morning of pickup day, rather than putting it out the night before	[ ]1	[ ]2	[ ]3	[ ]4	[ ]5	[ ]6
c. Feeding pets indoors	[ ]1	[ ]2	[ ]3	[ ]4	[ ]5	[ ]6
d. Not having composters, gardens or fruit trees	[ ]1	[ ]2	[ ]3	[ ]4	[ ]5	[ ]6
d. Removing bird, squirrel and other wildlife feeders	[ ]1	[ ]2	[ ]3	[ ]4	[ ]5	[ ]6
e. Keeping the doors and windows of your house and car closed	[ ]1	[ ]2	[ ]3	[ ]4	[ ]5	[ ]6
f. Keeping your pets inside	[ ]1	[ ]2	[ ]3	[ ]4	[ ]5	[ ]6

17. Which of the following is the **most** important reason you **would take action** to minimize your risk of negative interactions with black bears where you live? *(Please check only one.)*

[ ]1 I want to protect myself and my family from black bears.
[ ]2 It is easy to prevent or reduce negative interactions with black bears.
[ ]3 I want to keep black bears acting wild and eating natural foods.
[ ]4 I want to prevent bears from being killed or re-located because they caused conflicts.
[ ]5 My neighbors expect me to avoid attracting black bears into our neighborhood.
[ ]6 I received informational materials about the role I can play in reducing bear conflicts.
[ ]7 I received a notice of violation for not having my garbage secured.

18. Which of the following is the **most** important reason you **would not take action** to reduce your risk of negative interactions with black bears? *(Please check only one.)*

[ ]1 I have never experienced negative interactions with black bears.
[ ]2 I believe black bear conflicts are part of the cost of living where I do.
[ ]3 I do not believe I am at risk for black bear conflicts.
[ ]4 Black bears only cause problems during a short period of the year.
[ ]5 I believe black bears that come into areas where people live should be removed or killed.

19. Below are several statements that describe how you might feel you are able to control interactions with black bears and other wildlife. Please check the box that best describes your level of agreement with each statement.

	Strongly disagree	Slightly disagree	Neither	Slightly agree	Strongly agree	I am not sure.
a. I can have an influence on wildlife management decisions.	[ ]1	[ ]2	[ ]3	[ ]4	[ ]5	[ ]6
b. I have the ability to protect my property from wildlife.	[ ]1	[ ]2	[ ]3	[ ]4	[ ]5	[ ]6
c. I have very little ability to voice my opinions regarding wildlife management.	[ ]1	[ ]2	[ ]3	[ ]4	[ ]5	[ ]6
d. Whether or not I have a conflict with a black bear is mostly a matter of luck.	[ ]1	[ ]2	[ ]3	[ ]4	[ ]5	[ ]6
e. Black bear conflicts are not a matter of luck, but rather result from bad personal decisions.	[ ]1	[ ]2	[ ]3	[ ]4	[ ]5	[ ]6
f. I have very little ability to protect myself from black bear conflicts.	[ ]1	[ ]2	[ ]3	[ ]4	[ ]5	[ ]6
g. I believe that my actions can reduce my risk of having a negative interaction with a bear.	[ ]1	[ ]2	[ ]3	[ ]4	[ ]5	[ ]6
h. I believe that I am likely to have negative interactions with bears regardless of what I do try to prevent them.	[ ]1	[ ]2	[ ]3	[ ]4	[ ]5	[ ]6

Your Opinions about Colorado Parks and Wildlife. Colorado Parks and Wildlife (CPW) is the primary agency responsible for managing black bears in Colorado. Please answer the following questions to tell us what you think of CPW and the decisions they make.

20. Below are several statements that describe how you might feel about CPW's black bear management in the Durango area. Please check the box that best describes your level of agreement with each statement.

	Strongly disagree	Slightly disagree	Neither	Slightly agree	Strongly agree	I am not sure.
a. I am confident that CPW can effectively manage black bears.	[ ]1	[ ]2	[ ]3	[ ]4	[ ]5	[ ]6
b. I am confident that CPW responds appropriately to black bear conflicts.	[ ]1	[ ]2	[ ]3	[ ]4	[ ]5	[ ]6
c. I trust CPW to establish appropriate rules to manage black bear conflicts.	[ ]1	[ ]2	[ ]3	[ ]4	[ ]5	[ ]6
d. When it comes to bear management, I feel that CPW shares values similar to mine.	[ ]1	[ ]2	[ ]3	[ ]4	[ ]5	[ ]6

21. CPW takes actions to attempt to reduce negative interactions between black bears and people. How acceptable is it to you that CPW takes the following actions to manage black bears in the area where you live? *(Please check one for each item.)*

	Acceptable	Neither acceptable, nor unacceptable	Unacceptable	I am not sure.
a. Support city ordinances that require citizens to use bear-resistant garbage containers	[ ]1	[ ]2	[ ]3	[ ]4
b. Provide financial assistance to residents for bear-proofing garbage, gardens and fruit trees	[ ]1	[ ]2	[ ]3	[ ]4
c. Increase hunting licenses to increase bear harvest in areas with conflicts	[ ]1	[ ]2	[ ]3	[ ]4
d. Fine individuals who are feeding bears intentionally or unintentionally	[ ]1	[ ]2	[ ]3	[ ]4
e. Trap and relocate bears that cause conflict	[ ]1	[ ]2	[ ]3	[ ]4
f. Kill bears that cause multiple conflicts	[ ]1	[ ]2	[ ]3	[ ]4

Background Information. The following questions will help us understand more about the people affected by black bear management in Durango. All responses are confidential.

22. Did you or someone in your household complete a questionnaire, similar to this one, about living with black bears in 2014? *(Please check one.)*

[ ]1 Yes [ ]2 No [ ]3 I am not sure.

23. Did you or someone in your household complete a questionnaire, similar to this one, about living with black bears in 2011? *(Please check one.)*

[ ]1 Yes [ ]2 No [ ]3 I am not sure.

24. Are you the person primarily responsible for actions and decisions about how your household's garbage is handled? *(Please check one.)*

[ ]1 Yes [ ]2 No

[ ]3 I share responsibility with another household member.

25. What type of garbage container do you currently use at your home? *(Please check one.)*

[ ]1 Manufactured wildlife-resistant *residential* can
[ ]2 *Residential* can that you modified to be wildlife-resistant
[ ]3 Regular *residential* can
[ ]4 Wildlife-resistant *commercial* container or dumpster
[ ]5 Regular *commercial* container or dumpster
[ ]6 Other *(Please indicate. _____)*

26. How many fruit trees grow on your lot? Please include **only** domestic fruit trees such as apples, pears, and plums. **Do not include** any decorative or native fruit bearing trees or shrubs like chokecherries, serviceberry, or crab apples. *(Please indicate.)*

_____ fruit trees

27. Do you currently own or rent the home in which you live? *(Please check one.)*

[ ]1 Own [ ]2 Rent

28. Are you [ ]1 male or [ ]2 female? *(Please check one.)*

29. In what year were you born? *(Please indicate.)* 19 _____

30. What is your highest level of education? *(Please check one.)*

[ ]1 Less than high school diploma
[ ]2 High school graduate or GED
[ ]3 Vocational or trade school
[ ]4 Some college
[ ]5 Associate's Degree (2 year)
[ ]6 Bachelor's Degree (4 year)
[ ]7 Graduate/Professional Degree

31. Please use the space below to provide any additional comments you may have about black bears and their management in this area.

THANK YOU FOR YOUR TIME AND ASSISTANCE!

Please return this questionnaire in the postage-paid envelope provided.