Predicting Human - Wildlife Conflict: Analyzing Landscape Change and Urbanization Impacts on Black Bear Populations

A Bren Group Project | Winter 2022 – Spring 2023

UC SANTA BARBARA
Bren School of Environmental Science & Management

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OBJECTIVE

Black bears (*Ursus americanus*) are one of California's most charismatic, recognizable mammals, and have been recolonizing the state in recent years. They have been identified as an important ecological component to California's wildlands, with research suggesting that this species is following human expansion to utilize anthropogenic resources.[1] Bears are increasingly utilizing human-dominated landscapes, which has the potential to increase both the frequency and specific regional occurrences of human-wildlife conflicts.[2,3] By analyzing historical and present-day black bear range maps, habitat suitability models, human population demographics, drought and fire impact information, and human-wildlife incident reporting data, we will examine relationships between humans, habitat, and wildlife as factors that may indicate where managers can anticipate future conflict.[4] This project will:

1. Perform a literature review to understand the historical and ecological context of black bear management and drivers of human conflict with bears.
2. Use GIS modeling to identify where these conflicts will most likely occur and create a mapping tool to inform CDFW management about where bear management practices can be most effectively implemented to mitigate conflict.
3. Creating a formal white paper report using results from GIS mapping and literature review to inform resource and conflict managers on best practices.
4. Create an informative pamphlet and organize outreach events to educate the public on the ecological importance of bears and techniques to mitigate conflict based on our findings.

SIGNIFICANCE

The increasing intensity of wildfires and droughts in recent years, paired with rapid urban expansion, raises concerns about the increase of human-black bear conflict in California as bears retreat to urban landscapes. Due to climate change, wildfires have become more intense and frequent, and drought more extreme, than ever before.[5] The California Department of Fish and Wildlife (CDFW) recognizes the growing need to understand how and why human-wildlife conflicts occur, how to address future incidents, and where managers can anticipate increased conflict as wildlife shift their use of landscapes.[6] Black bears are an important conflict species, and a significant amount of time and resources are dedicated to managing conflict with them in California. Understanding where conflicts are likely to occur will help CDFW allocate these resources more efficiently.[7] Bears seek resources such as garbage, fruit trees, and bird feeders in urban areas,[8] which are also refugia from drought and wildfires due to irrigation and fire suppression. It is likely that these three factors (drought, fire, and urban expansion) all affect where black bears occur alongside humans and consequently where conflict is likely to be highest.

CDFW seeks to incorporate these factors to identify where human-bear conflict is most likely. The intensity and frequency of wildfires and droughts have massively increased since 2015, driving a need to collect data to understand how black bears are responding to these new conditions. To date, not enough geospatial analyses have been conducted to assess where the overlap of drought, fire, urban expansion, and suitable bear habitat is greatest. These are the areas of highest potential conflict today and in the future. To fill this informational gap, we'll utilize existing data on habitat suitability, fire and drought occurrence, urbanization trends, and human-wildlife incident reports to evaluate and predict bear land usage and provide a visual representation of where conflict is likely to occur. This will help managers distribute resources to areas with a high probability of human-wildlife conflicts to address problems before they occur.[9] The outreach portion of the project aims to engage with these communities to

maximize the efficacy of management efforts. This will assist CDFW in their efforts to better serve Californians living within different communities to prevent human-bear conflicts and enable more focused education and direction for future wildlife management strategies.

This project will provide data to inform CDFW on where to focus their efforts in human-bear conflict, and can serve as a model for assessing conflict with other species. Seeking resources in human areas is not unique to bears. We hope to use this study of black bears as a model for assessing future conflict and management needs of other conflict-prone species such as mountain lions, bobcats, and coyotes, as the management issues that concern black bears also apply to many of these species.

BACKGROUND

California is the most biologically diverse and populous state, with more than 39 million people residing within suitable habitats for an array of species.[10,11] As human development expands, black bears have responded to meet their behavioral and ecological needs within a changing landscape.[12] Bears have shifted from utilizing primarily wild resources to readily-available anthropogenic resources.[13] The availability of garbage in urban areas presents an attractive, high-value, easy food source for bears. This has led to a significant increase in black bear presence and instances of interaction with humans.[14] As black bears have expanded their range into human landscapes, reports of human-wildlife incidents have increased.[15] Increased conflict is reflected in higher bear mortality due to anthropogenic causes in recent years, particularly in young females, which affects population structure and viability of urban bears.[16]

Climate change also plays a role in the spatial movement of black bears. Conflict between humans and bears increases during drought years,[17] and droughts are becoming more extreme as a result of climate change.[18] Conflict with bears is also more likely in areas where human development is near quality bear habitat such as oak scrub,[19] and areas with such dense vegetation are often susceptible to fires. The increasing frequency and intensity of wildfires throughout California are directly caused by climate change,[20] and the resulting habitat destruction has implications for black bear management and conflict. Destruction of vegetation from increasingly intense wildfires makes severely burned areas unsuitable for bedding and denning,[21] which may be pushing bears toward urban areas as they are refugia from wildfire due to fire management practices. Bears also seek out urban areas during years where food is scarce, leading to increased conflict with humans – and food scarcity is likely to become increasingly common due to the impacts of climate change.[22]

Urbanization, drought, and wildfires are all increasing as climate change progresses and human populations expand. Conflict between humans and black bears is harmful to both parties and is likely to increase. It's critical to conduct a conflict risk assessment that incorporates these factors to provide wildlife managers with information to best allocate resources to address this complex issue.

EQUITY

California is home to a population that is expected to grow to 50 million by 2050.[23] CDFW recognizes the necessity and value of diversity and equity in the department, and in its approaches to solving environmental issues.[24] To meet this standard, our published outreach materials will be made available in a few different languages to better serve California communities. We will also provide materials to underserved communities with limited access to CDFW resources and information.

AVAILABLE DATA

This project will make use of the following publicly available data:

- Peer-reviewed literature to understand factors that contribute to human-bear conflict
- Publicly available GIS data for recent wildfire and drought areas from the National Oceanic and Atmospheric Administration (NOAA), CalFire, and the United States Forest Service (USFS)
- United States Census Bureau data to understand increasing urban density and areas that expand into black bear range and habitat

In addition to this publically available data, CDFW will provide the following data:

- CDFW's existing Biogeographic Information and Observation (BIOs) database includes geospatial data from a number of sources on habitat, fire, range, etc.
- CDFW's Wildlife Incident Reporting System (WIR) database collects data on incidents involving human-wildlife conflict.
- CDFW's California Wildlife Habitat Relationship (CWHR) is a database that contains life history, range, and management data for 712 wildlife species within 59 habitat types.

POSSIBLE APPROACHES

1. **Conduct a literature review** to understand the historical and ecological context of black bear management and drivers of human conflict with bears.
2. **Create a statewide GIS overlay map of factors affecting conflict.** This task will involve compiling CalFire data, urban area/population density data, CDFW black bear range, and other publicly available data to determine the regions where we expect the highest amount of conflict.
3. **Create multilingual outreach materials for the most impacted communities and organize events to help them understand how to prevent wildlife conflict.** This task will involve presenting our findings with pamphlets and organizing events such as "Bears and Brews" public talks at local breweries or town halls in the most impacted communities to help make our findings more accessible.
4. **Create a white-paper report to communicate project findings and recommendations to CDFW.** This task will involve a literature review to identify best practices that have historically been used to reduce human-bear conflict. It will also involve formally describing the findings of the project.

DELIVERABLES

- A GIS overlay display incorporating distribution, map, and model data to identify regions that may experience increased human-wildlife conflicts.
- A finalized report using results from GIS mapping and literature review to inform resource and conflict managers on best practices.
- An informational pamphlet incorporating these findings that can be used for public outreach and education to increase popular knowledge on best mitigation practices and current projects to ensure bear and human health.

INTERNSHIP

CDFW can commit to providing an unpaid internship to one student working on the group project. CDFW cannot commit to financial support at this time due to limited resources. Therefore CDFW has offered a 2-10 week internship as a scientific aid with state employee status as part of their natural resource volunteer program in Sacramento, CA.

CITATIONS

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BUDGET AND JUSTIFICATION

The budget for this group project is not projected to exceed the $1,300 provided by the Bren School. Costs will mainly be for travel to see and speak with members of the communities that our findings have projected will have the highest potential for human-bear conflict.

CLIENT LETTER OF SUPPORT

Please see the attached document for the client's letter of support.

State of California – Natural Resources Agency
DEPARTMENT OF FISH AND WILDLIFE
Director's Office
P.O. Box 944209
Sacramento, CA 94244-2090
www.wildlife.ca.gov

GAVIN NEWSOM, Governor
CHARLTON H. BONHAM, Director

January 18, 2022

Alexander Heeren, Ph.D.
Research Scientist
Human Dimensions of Wildlife Unit
Wildlife Health Laboratory

SUBJECT: Support for Bren Group Project with the Human Dimensions of Wildlife Unit

Dear Group Project Committee at The Bren School of Environmental Science & Management, University of California, Santa Barbara,

I am writing to express my support for the proposed student group project: "*Predicting Human-Wildlife Conflict: Analyzing Landscape Change and Urbanization Impacts on Black Bear Populations*." I believe this potential student group project has great value towards identifying communities in California that have a high probability of experiencing conflict with black bears. Understanding these communities, and their potential concerns about wildlife, is instrumental in helping them coexist with wildlife. This work meets the important need to understand how urbanization, wildfires, and droughts interact to affect the risk of black bear-human conflict.

Currently, we receive reports of human-bear interactions through the online Wildlife Incident Reporting System. However, we do not have a framework for identifying areas that may experience conflict with bears outside this reporting system. Many communities lack the awareness of the system or the ability to use the system to report conflicts with wildlife. Therefore, our existing database does not encompass the full range of human-bear interactions. The proposed project is a first step in remedying this data gap. By merging datasets, the students will help assess different regions to predict areas that are susceptible to human-bear conflict.

As the lead research scientist for the Human Dimensions of Wildlife Conservation Unit, I am excited to provide guidance and mentorship to the Bren Group graduate students on this project. We can provide one or more unpaid internship opportunities for students. I have a lot of experience working with students and teams remotely/virtually and providing a high level of engagement and professional development. If you have questions, you may contact me by email (Alex.heeren@wildlife.ca.gov) or phone at (916) 212-3233.

Sincerely,

Alex Heeren, Ph.D.
Human Dimensions Research Scientist
Wildlife Health Laboratory
California Department of Fish and Wildlife