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Applying an Agent-Based Modelling Approach to Simulating Spring Black Bear Hunting Activities in Prince William Sound, Alaska

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Introduction

Black bear harvest levels have increased rapidly during the past 10 years in Prince William Sound (PWS), Alaska. Alaska Department of Fish and Game (ADF&G) has found a 100% increase in reported bear harvest between 1995 and 2001. In regulatory year 2001/02, this area reached a record of 436 bears taken which was approximately 25% more than any other black bear harvest unit in Alaska. The Chugach National Forest (CNF) which manages the vast majority of the land surrounding PWS desired a tool with which to assess the spatiotemporal distribution of the spring black bear harvest with hopes of assessing its overlap with other recreational groups. This study combines Geographic Information Systems (GIS) with existing standardized harvest datasets and an agent based modeling approach to analyze complex, spatially dynamic patterns of black bear hunting in PWS. This study illustrates that human use simulation modeling, driven by a harvest record dataset, can inform decision making to positively and proactively manage human-landscape interactions and enhance long-term management of harvested wildlife populations.

Methods

Black bear harvest season is open from September 1 – June 30, although the majority of harvest (~80%) occurs in during May and June. In this six-week period, bear hunters likely become the most prevalent recreation use group on the shoreline of PWS. CNF has received several reports of user conflicts in the western Sound between bear hunting groups and other non-harvesting use of the shoreline during late May and early June. Using RBSim2 (Itami et al. 2003) in conjunction with a harvest database containing location information for bear kill sites in the area. A rule based simulation was constructed to develop a comprehensive understanding of the relationship between the spatial-temporal patterns of hunter use and bear harvest in PWS. The simulation outputs provided a direct method for integrating an understanding of the implications of visitor use on the management of biological systems and identify potential locations of user conflict.

Results

There are several interesting findings from the simulation outputs based on the Bear harvest data, logical assumptions and rules derived from expert. Peak hunter use days ranged between 315 and 503 on the main travel routes to less than 26 days in remote areas. There was a cumulative use of routes over the nine year period ranges from 1015 to 2338 visitor hunter use days. While the average hunter use per day for each node was approximately 3.5, these averages generally fell below 2 per day for the nine years. However, over nine years

(1996-2004) the amount of hunter use days ranges widely from over 10,000 to less than 2,000, depending on the Capacity Area (CA). Not all CAs were used equally. Some hunting areas received considerable more use than others. For example, CAs such as 5 (6,000 – 10,000 hunter days), 12, 13, 16 and 17 (2,000- 6,000 hunter days) are the most heavily used in the study area. These same CAs consistently have the highest number of total visits and trends in bear habitat and overnight facilities. But CA 5 receives the most visitor use days and number of bear taken. Capacity entries 1 (CA 18), 13 (CA 52) reveal some commercial use but dominated mostly by non-commercial activity. Locale entries 12 (CA 49), 68 (CA 16), 71 (CA 17) & 78 (CA5), reveal equal if not dominant commercial versus non-commercial use. In other words in these four areas there is a significant amount of reported commercial activity. The later 3, 5, 16 & 17 in earlier analysis are not only the sites most frequently visited by commercial activity, but also are the most frequented overall, account a high percentage of the areas where the most bears are harvested and where the duration of stay and the most overnight activity occurs. Private boats accounted for approximately 75% of the travel use entering into the CAs and Water Taxis an additional 15%.

There is a growing body of research focused within the context of human-environment interactions. This work examines the need to develop a comprehensive and empirically based framework for linking the social, biophysical and geographic disciplines across space and time. While this prototype still requires further validation, it strongly illustrates the potential of human use simulation modeling to bridge a significant social science knowledge gap to improve the ability of decision making to positively and proactively manage human-landscape interactions and promote long-term protection of the landscape.

References

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