Stakeholder inclusion aids adaptive management of wildlife populations, finds ptarmigan study in Norway

Sustainable management of wildlife populations must account for natural dynamics and be able to make future predictions on desired temporal or spatial scales. This is increasingly important given the pace of current and future climate change. This study explores the efficacy of involving key stakeholders early in the management process, to define objectives, datasets, models and analyses in a participatory and collaborative way. The researchers use this approach to model and forecast the population density of the willow ptarmigan (Lagopus lagopus) in Norway.

The willow ptarmigan is a popular game species in Norway. Like many other alpine and Arctic bird species in Europe, ptarmigan numbers are declining, and Lagopus lagopus was added to the Norwegian Red List for Species in 2015 as ‘Near Threatened’. However, the exact ecological mechanisms behind ptarmigan decline remain unclear, and there is a need for modelling and forecasting to aid policy development for effective population management.

This study employs an ecosystem-based approach to modelling and forecasting, developing a mathematical model of willow ptarmigan population dynamics. The analysis spanned 17 years of data and covered the largest management area for ptarmigan in Norway (roughly 45 000 km² in area: the Finnmark Estate). The researchers involved end-users early in the process via a Strategic Foresight Protocol (SFP) which incorporates the knowledge, views and needs of key stakeholders — the major landowner (FeFo), hunting representatives, governmental management authorities and conservation bodies — in decision-making on the model’s structure and purpose.

The stakeholders collaboratively decided that modelling should be based on a food web approach, with forecasting ability made a priority. A conceptual food web model was built to highlight the biotic interactions thought to affect short-term ptarmigan population dynamics and longer-term trends.

The SFP-based process had two overarching aims: to make explanatory predictions of ptarmigan dynamics (i.e. identify correlating factors and drivers in the timing and extent of past observed ptarmigan population change) to yield a more comprehensive understanding of the species, and to make anticipatory predictions (i.e. provide near-term forecasts of how populations will change in the future) to inform
stakeholders and guide adaptive management decisions. Rather than generating novel predictions for the future, this study tested the model’s ability to predict population dynamics over time, referring to a real (past) dataset to corroborate accuracy. Data came from FeFo’s spatially extensive survey of willow ptarmigan across Finnmark, northern Norway, which occurred yearly from 5 to 20 August from 2000 to 2016.

In terms of explanatory predictions, the results showed that ptarmigan population growth was significantly influenced by changes in climate; was negatively impacted by harvesting and by increased precipitation around the time of hatching; and slowed as winter began later in the year. Drivers of population change (both positive and negative, direct and indirect) included increased reindeer carrion feeding generalist predators; seasonal vegetation change; the hunting season; an outbreak of vegetation-stripping geometrid moths; temperature and precipitation; and the onset of winter.

Regarding anticipatory predictions, the model accurately predicted short-term population trends, returning forecasts that, on average, aligned with observations. Its forecasting ability will improve as datasets grow and combine intensive small-scale demographic studies with large-scale population monitoring, say the researchers. While the SFP process has not yet reached the stage of decision-making on management action, consensus has been reached about the likely drivers of ptarmigan dynamics, the datasets to be used, and how modelling should be used to explore the near future.

Overall, the researchers highlight the importance of early stakeholder involvement in defining wildlife management strategy, especially given that some drivers that proved influential in ptarmigan modelling were included, based on stakeholder observations, and may not have been included in a purely researcher-driven process (for example, local observations of ptarmigan plumage and its camouflaging abilities and, importantly, the potential impact of forest defoliation and death due to moths, leading to a shift from woody vegetation — food for ptarmigan — to mainly grass). They state that an open, flexible and iterative process, rather than a rigid protocol, facilitates rapid learning, trust and legitimacy, and can aid environmental decision-making and policy development as part of an adaptive approach to annual management — crucial in times of rapid, uncertain and unprecedented change.

1. The researchers note that populations of multiple ptarmigan and other ground-nesting bird species in European ecosystems are all in decline, a trend that suggests that drivers of change are not species-specific but instead connected to wider ecosystem changes.
2. The value of early stakeholder participation has been advocated for some time, and this study acts as an example of applying a structured protocol: the SFP, which has been proposed for rapidly emerging problems in applied ecology.