Decreasing snow cover duration is one of the strongest signals of climate change across the temperate zone of the Northern hemisphere (Brown and Mote 2009, Pederson et al. 2011). The resulting later onset of snow in the fall and earlier loss of snow in the spring represents a new, potentially severe stressor for at least 13 color molting species and their respective communities. Those animals include important forest prey such as snowshoe hares (*Lepus americanus*) in North America and mountain hares (*Lepus timidus*) in Eurasia, that turn from brown to white in winter to match the snowy background and escape predation. Similarly, predators including Arctic fox (*Alopex lagous*) undergo seasonal color molts to reduce the risk of being detected by their prey. But because of climate change, animals’ coat color molts are mistimed with the shorter duration of snow cover and their camouflage becomes compromised (Fig. 1). White animals appear extremely conspicuous against the non-snowy backgrounds which might have serious consequences for their survival and/or hunting success.

In my Master’s research I focused on the effects of camouflage mismatch on snowshoe hares in Montana. My collaborators and I found that hares suffer increased mortality rates when mismatched and predicted that under future climate change scenarios their population growth rate will strongly decline towards extinction by the end of the century (Zimova et al., In Prep.). Further, we found they have very little ability to adjust the timing of their color molts to the immediate snow conditions (Mills et al. 2013); and that they do not modify their behaviors such as fleeing or hiding to reduce camouflage mismatch (Zimova et al. 2014). I continue to examine the effects of camouflage mismatch on snowshoe hares as a PhD student at NCSU Department of Forestry and Environmental Resources and will expand my research to other color molting species around the world.
With the assistance of the Laarman Gift Fund I traveled to Scotland and Sweden to seek new collaborations with researchers working on color molting species in Europe. In Scotland I met with two researchers at the James Hutton Institute in Aberdeen, Glenn Iason and Scott Newey, who have been studying mountain hares in Scotland for over 20 years. They agreed to collaborate with me on a new project, which will take advantage of the excellent data on snow cover and hare color molts from Scotland from the 1950s-1960s (Watson 1963, Flux 1970) and 1980’s (Iason, Pers. Comm.). We will collect data on present molt timing and snow conditions and compare them to the historical data sets. This will enable us to determine whether hares have already adapted their molts to the shorter duration of snow cover over the past 60 years and assess resilience of this species to future climate change. We explored potential study sites (Fig. 2), discussed funding opportunities and decided to begin with data collection in March 2015.

Next, I traveled to Sweden to visit Dr. Anders Angerbjorn, professor of ecology at the Stockholm University, who studies Arctic foxes in Scandinavia. He monitors fox reproduction and survival using camera traps installed by their dens (Fig. 3). We drafted a proposal for a new collaborative project that will use these cameras to collect data on fox color molt timing and camouflage mismatch. This project represents a new valuable component to my research as it will enable me to investigate the effects of camouflage mismatch on a predatory species and to examine whether color molts are passed from parents onto their offspring. The study will also initiate in spring 2015.
While I was in Sweden I stayed at the Stockholm University field research station near Gnesta (Fig. 4), where I attended a part of an ecology field course taught by Dr. Anderson and gave a research seminar on my work to a class of undergraduate students. Additionally, Dr. Angerbjorn introduced me to the head of Swedish hunting association Jonas Kindberg who has an access to the Swedish hunters’ bag records. We discussed a project in which we can gain and analyze color molt data from mountain hares shot by hunters. Lastly, I met with Carl-Gustaf Thulin, a renowned hare biologist at the Swedish University of Agricultural Sciences in Uppsala, who showed a keen interest in collaborating with our group on genetics research of the color molting and offered to donate his collection of over 1,000 hare DNA samples.

I would like to express my sincere gratitude to the Laarman Gift Fund to help me explore new research directions and establish new international collaborations. I believe both my PhD research and my career as an international conservation biologist will benefit greatly from those new experiences and connections. Further, the fund enabled me to establish potentially strong and long-lasting international collaborations between the NCSU Department of Forestry and Environmental Resources, The James Hutton Institute and Stockholm University.

Thank you!

Marketa
References: