S A V E T H E A N I

PAWS, an "intelligently" randomized scheduling system, holds the promise to frustrate poachers in Uganda and elsewhere.

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The PAWS randomized scheduling system will keep the poachers guessing. ***[editorial art by David Myers]***

At Queen Elizabeth National Park in Uganda, poachers win more often than not, to the detriment of local animal populations.

Because of limited resources, only 79 wildlife rangers patrol the park's more than 1,900 square kilometers, or one ranger for about every 24 kilometers. Compounding matters, some neighboring villagers inform poachers of rangers' comings and goings, making it easier for the bad guys to pierce the already porous security network.

The result: the slaughter of cape buffalo, waterbuck, warthogs and giant forest hogs, which are served up locally and exported illegally as "bush meat." Additionally, poachers target lions, leopards and hyenas for their skins and teeth and to eliminate potential threats to livestock. They kill elephants for their ivory.

USC Viterbi computer scientist Milind Tambe and his team—including collaborators Andrew Lemieux, a criminology researcher who works closely with the Ugandan national park, and USC Viterbi PhD students Rong Yang and Benjamin Ford—hope to put an end to the carnage. Tambe, a renowned expert in creating randomized patrol schedules to thwart terrorism and other crimes, has leveraged that knowledge to build a new security system to protect against poaching.

"The ecosystem is thrown out of balance by poaching, and there are unintended, unforeseen and adverse consequences as a result," Tambe said. "I think we can make a contribution in the fight against it."

The Protection Assistant for Wildlife Security, or PAWS, will create "intelligently" randomized schedules for ranger patrols, using complex algorithms. Randomization optimizes the use of limited security patrols by making it impossible for would-be poachers to determine when a particular area will be protected. Intelligent randomization, a core of PAWS and Tambe's other security systems, means that software programs ensure that rangers will make more visits to areas most targeted by poachers.

Since 2007, Tambe and his team have rolled out intelligently randomized scheduling systems used by the U.S. Coast Guard, the Transportation Security Administration and the Federal Air Marshal Service to protect American ports, airports and airplanes.

Tambe's research is rooted in mathematical game theory, which tries to predict how conflict might play out between adversaries. According to the Bayesian Stackelberg game theory, the offense (in this instance, the poachers) observes the defense (park rangers), to identify and exploit any possible security weaknesses. PAWS' rigorous game-theoretic modeling and algorithms stymie the bad guys by creating randomized schedules with no discernible patrol patterns.

Information gleaned from studying past crimes and from apprehended poachers will help create better

algorithms for models, resulting in ever more effective patrols, Tambe said. He expects Queen Elizabeth National Park officials to test PAWS this spring.

PAWS has attracted widespread interest. Mahendra Shrestha, head of the Tiger Conservation Partnership program at the Smithsonian Conservation Biology Institute in Washington D.C., has met with Tambe and his team to discuss the system's benefits.

"There is definitely a good potential to join forces with PAWS for better tiger conservation and for their recovery in the wild," said Shrestha, noting that poachers have wiped out more than 97 percent of the world's tiger population over the past century. "I see a great possibility to use the expertise of Dr. Milind Tambe and his team at USC."