Building a Better BurrowBot:
Using Robotics to Explore Gopher Tortoise Ecology

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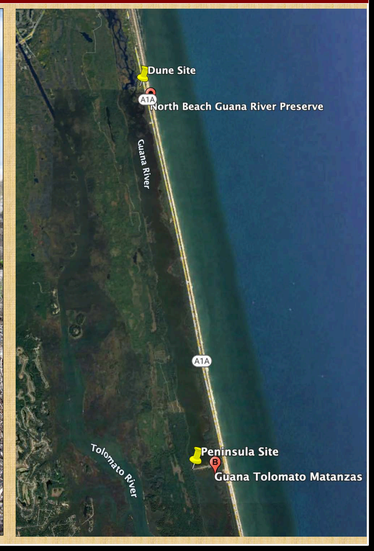
Introduction

There is a plethora of literature published on gopher tortoises (*Gopherus polyphemus*) in upland habitats, but very little is known regarding their ecology in coastal dunes (Lau & Dodd, 2015). Catano & Scout (2015) and Dziadzio & Smith (2016) identified 22 and 37 commensal species, respectively, in other types of upland habitats. Some identified taxa, for example the gopher frog (*Lithobates capito*) (Smith et al, 2013) are considered threatened or endangered by the Florida Fish and Wildlife Conservation Commission (FWC). Our research will create a knowledge base for natural resource managers to advocate for imperiled and common species in coastal dune habitats – including gopher tortoises and the commensals who rely on them (Alexy et al, 2003).

Using the BurrowBot

Study Sites



Methods

- We built a robotic apparatus to convey our EMS2012 (Gopher Tortoise Camera System) using a combination of components, including the DAGU Rover 5 and the Elegoo Uno r3.
- We custom-designed a camera mount, and programmed the tank-like chassis, to enter gopher tortoise burrows in various habitat types. The robot is directed via remote control.
- The portable tank-like robotic apparatus conveys our burrow camera system into active tortoise burrows safely, maintaining the camera lens orientation during burrow descent.
- The EMS2012 relays live visual data to a paired KS639M Digital Video Recorder (DVR) for controlled analysis of captured imagery in the laboratory.
- We will note burrow occupancy, depth, temperature profile, and commensal species.

Preliminary Results

We find that the current robot is only effective in larger burrows; design changes will make it more accessible to smaller burrows in the future. Our “BurrowBot” makes capturing footage more efficient, and maintains the camera's orientation effectively, meaning less post-production of photos is needed.

The footage we get with the robot is more usable because the camera is kept out of the sediment, meaning the images are clearer and will therefore offer a better overall view of the burrows and the organisms inside them. The robot’s operator can also focus on the live footage, rather than having their attention divided between maneuvering the camera and later reviewing the visual data.

Discussion

We collaborated with a Flagler College student club, “F.S.T.E.A.M.” – short for Flagler Science, Technology, Entrepreneurship, Arts, and Mathematics to develop our robot. This is a new example of the cooperative and interdisciplinary nature of conservation tools.

In the future, we hope to use this robot to conduct research that will inform land and gopher tortoise management – and broaden our understanding of the dynamic ecology of gopher tortoises in these understudied parts of their range.

We are currently in the process of fine-tuning our student-built robot. Thus far the technology is promising.

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