Spatiotemporal changes in trouts' thermal refuge on Little Jacks Creek, Owyhee County, Idaho

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Abstract

We have investigated the stream temperatures with the unmanned aircraft system (UAS) on Little Jacks, Duncan, and Big Jacks Creek in Owyhee County, Idaho, for three different seasons in 2019. The thermal orthomosaics created for three different seasons were draped on the visible band's digital elevation models (DEM) to show the spatial distribution of the stream temperature and how it has changed over three different seasons. This survey will be used to monitor the spatiotemporal changes in thermal refuge for trouts in this area.

Research questions

How the thermal refuge for trouts change spatially and seasonally?

- How the stream temperatures on Little Jacks Creek change spatially and seasonally?
- What is another factor that affects the stream temperature?

Introduction

UAVs provide data with high spatial-resolution with low-altitude flights over a larger area not possible with field surveys at relatively low cost (Dauwalter, Fesenmyer, Bjork, Leasure, & Wenger 2017).

We are presenting preliminary results we have gotten on Little Jacks Creek by performing airborne remote sensing with unmanned aircraft system (UAS) in three different seasons in 2019.

The thermal refuge can be identified by calculating the surface temperature of a stream from the IR imagery taken with UAS. By investigating the stream temperature with airborne remote sensing, we expect that we can understand how the thermal refuge for trouts changes spatially and seasonally.

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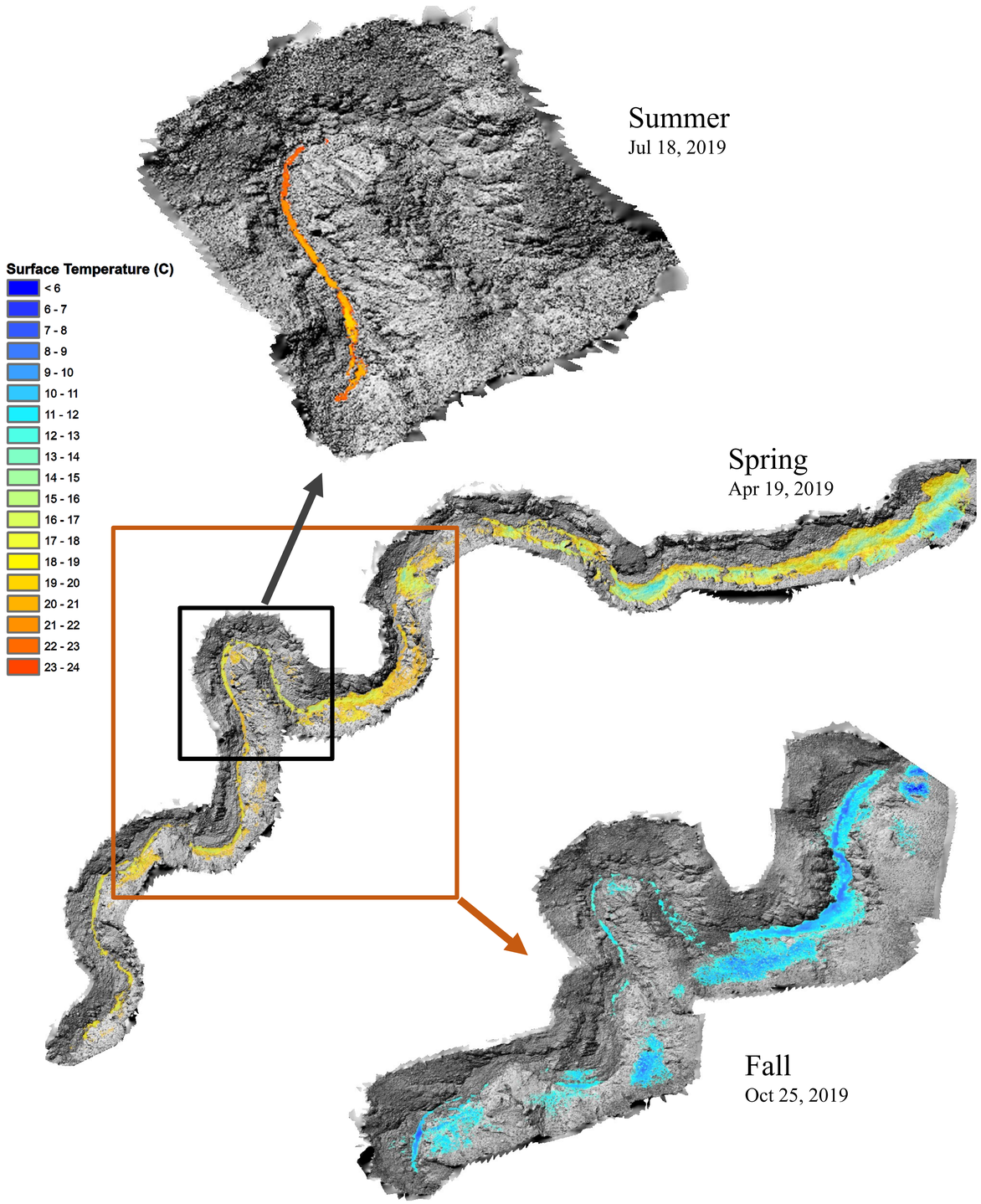
RESULTS

Seasonal variation of the stream temperature distribution on Little Jacks Creek, Owyhee County



METHODS

We have performed an airborne remote sensing survey in visible and IR bands using DJI Matrice 600 UAS with FLIR Duo Pro R in Owyhee County on April 19, July 18, and October 25 in 2019.

We created digital elevation models (DEMs) from the visible-band raster images. The stream temperature was calculated from the thermal raster images. The thermal data is draped on DEM to show the distribution of the land surface temperature visualized on the terrain. The surface temperature higher than 24° C does not appear in this composite image. The majority of the area hotter than 24° C actually corresponds to the land surface other than the stream.

Discussion

The stream temperature changed spatially and seasonally along with the land surface temperature. It did not change continuously from upstream through downstream but has shown some isolated patches of colder or hotter water. It can be understood as the result of vegetation cover, shadows of trees or cliffs casted on the stream, the groundwater flow., and other factors such as the depth and mixing of stream water.

FUTURE STUDIES

We will continue to investigate the stream temperature by repeating the airborne survey over the same area and by extending the survey areas in order to have a better understanding on the spatiotemporal changes in thermal refuge for trouts. We will need to build a model to take the ground-based survey of stream parameters into account. The diurnal change of the temperature should be taken into account to better understand the seasonal changes of the stream temperature. The influence of precipitation, groundwater flow, and cooling by shadow need to be considered as well.

References

Dauwalter, D. C., Fesenmyer, K. A., Bjork, R., Leasure, D. R., & Wenger, S. J. (2017). Satellite and Airborne Remote Sensing Applications for Freshwater Fisheries. *Fisheries*, *42*(10), 526–537. https://doi.org/10.1080/03632415.2017.1357911