Evaluating Bioenergy Potential of Eastern Redcedar (Juniperus virginiana L.) Using a Small Unmanned Aircraft System (sUAS)

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Eastern Redcedar (*Juniperus virginiana* L.)

- Kansas’ only native juniper species
- Characterized by rapid growth and reproduction
- Coniferous species which has sharp “scales” instead of leaves
- Evergreen (vs. deciduous)
- Has a native range from northern Florida to Ontario
- Highly invasive

Image courtesy of Kevin P. Price
KSU Howe Property, Blue River Hills
1962

Courtesy KSU Historical Aerial Photograph Archive
Redcedar Uses

- Eastern redcedar is commonly chipped into mulch for use in landscaping and gardening
- Redcedar can be chipped and burned in large boilers to heat buildings
- Biodiesel
- Biochar - soil amendment used to neutralize toxic substances

Redcedar mulch near Pratt, Kansas
Since redcedar wood has been shown to be useful and there is a lot of it out there, how can we map redcedar stands and quantify biomass?
Multi-date Supervised (SVM) Classification
Riley County, Kansas, 2011

- Agricultural Land
- Deciduous Forest
- Rangeland
- Eastern Redcedar
- Urban
- Water
- Wetland

Eastern Redcedar Producer (Omission) Accuracy: 93%
Eastern Redcedar User (Commission) Accuracy: 100%
Overall Classification Accuracy: 81%
Total Area of Eastern Redcedar Cover: 6269 acres

Classification and Cartography by David Burchfield
Contributors: Johnny Bryant, Kevin Price, Larry Biles, Ross Hauck
Once we have identified areas of concern at a small scale (30m pixels), how can we further evaluate these stands to get more detailed information?
Ritewing Zephyr II
LDP LLC – modified Canon Powershot S100 NDVI Camera
GoPro HD Hero3 Video Camera
Ardupilot Mega 2.5 Autopilot

Image courtesy Joel Prince
GoPro Video
Very poor light conditions!

Image courtesy Joel Prince
Mosaicking Process

- Individual images get combined into a mosaic in Agisoft Photoscan Professional
Mosaic Result
Eastern Redcedar Canopy Area versus Biomass

Some data from Strauss, et al. (2011)
Measured 8 individual trees of various sizes – very small redcedar population at Rannells because of annual burning
Using regression equation to predict biomass of each tree

\[
Total \text{ aboveground biomass} = 17.10(\text{canopy area}) - 36.47
\]

Example:

\[
Total \text{ aboveground biomass} = 17.10(73.6 \text{ } m^2) - 36.47
= 1222 \text{ kg}
\]
Future Work/Lessons Learned

• Repeat in area with higher number of isolated redcedar of various sizes
• Fly on a bright, sunny day rather than in variable light conditions to improve mosaic quality
Questions?