



Applied Remote Sensing in the Middle Rio Grande

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Introduction: Landscape Scale Monitoring

plant and animal communities are as much a product of past events as they are an illustration of contemporary processes

-Gordon G. Whitney

- Tamarisk Leaf Beetle (TLB) in the Middle Rio Grande (MRG) since approximately 2012
- TLB negatively impacts SWFL breeding and nesting habitat on a landscape scale
- The MRG Endangered Species Collaborative Program (Collaborative Program) has coordinated annual monitoring within the MRG in order to determine distribution, identification of the species, and capture overall habitat changes
- Tamarisk may affect fire behavior in riparian settings
- Remote Sensing (RS) and vegetation indices (VIs) are ideally suited to monitor landscape scale ecosystem processes
- 2 use cases detailing data sources, workflow, and software:
 - Monitoring TLB-induced vegetation change (ΔNDVI)
 - Post-fire restoration analysis and planning (ΔNBR)





Remote Sensing and Vegetation Indices

- RS techniques can be used to track and quantify ecosystem processes, to understand the spatial-temporal variability of surface conditions
- VIs are the combination, or spectral ratio, of 2 or more bands to highlight particular features of vegetation and are calculated using the reflectance values of vegetation.
- NDVI is highly correlated with avian species richness, as noted in flycatcher and cuckoo models

NBR = <u>NIR-SWIR</u>

• NBR is correlated with burn intensity

(NIR - Red

(NIR + Red)

NDVI =







Study Design and Data Types

- Design is important (define goals) and geography is complicated, need to ID layers to represent the real world
 - What is being monitored?
 - What is the scale and will comparison be made?
 - Need to consider spatial and temporal implications
- Define region of interest, availability of cloud-free images, download, preprocess for repeated analyses
- Sentinel-2 vs LANDSAT
 - 10m/ high return time
- Need for high resolution/high return time
- Multispectral for band analysis







Software



ndvi_20160723

High : 0.81

Low : -0.14

Tamarisk Leaf Beetle Study

- MRG in Socorro County, NM
 - 25 river miles, 8,000 acres of bosque habitat
- Develop a workflow using Sentinel-2 to rapidly detect stressed tamarisk stressed stands and prioritize field efforts
- Use 2016 Hink and Ohmart vegetation mapping to mask 2,500 acres of tamarisk stands
- ΔNDVI to understand spatial and temporal patterns and quantify vegetation change
- Prioritized field efforts
- Use to coordinate further TLB and avian surveys





Tamarisk Leaf Beetle Study: Results

• Tamarisk stands: -5.7% decline

tamarisk other vegetation

• Non-tamarisk stands: 3.3% increase



	Number of Pixels	Acres	Percent
No Change	53814	1,329	52.7
Decline	26821	663	26.3
Increase	21550	533	21.0
Total	102185	2,525	100

tamarisk other vegetation





Tiffany Fire Rehabilitation Planning

- MRG in Socorro County, NM
- Major lightning caused fire event on June 26, 2017
 - Burned 9,200 acres of native, mixed, and exotic veg (primarily tamarisk)
 - Largest MRG fire in 20 years
- Significant loss of cuckoo habitat
- Tetra Tech analysis
 - River morphology
 - Historical and predicted changes to river slope
 - Groundwater conditions
 - Vegetation interaction with burn severity
- Develop scenarios for future conditions
 - Project looking at plant community patch restoration, fuel breaks, and infrastructure changes





Tiffany Fire Rehabilitation Planning ΔNBR Results

$\Delta NBR = NBRprefire - NBRpostfire$













Tiffany Fire Rehabilitation Planning ΔNBR Results





Tiffany Fire Rehabilitation Planning ΔNBR Restoration Planning





Tiffany Fire Rehabilitation Planning Site Selection & 30% Design





Tiffany Fire Rehabilitation Planning Site Selection & 30% Design





Tiffany Fire Rehabilitation Planning Site Selection & 30% Design





What now?

- Long history of use in predicting endangered species habitat
- Use RS to be more strategic in identifying where restoration opportunities exist on a landscape regardless of land ownership
- Develop more effective collaborative restoration projects
- Using RS to identify at-risk Southwestern Willow Flycatcher habitat at the reach scale













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