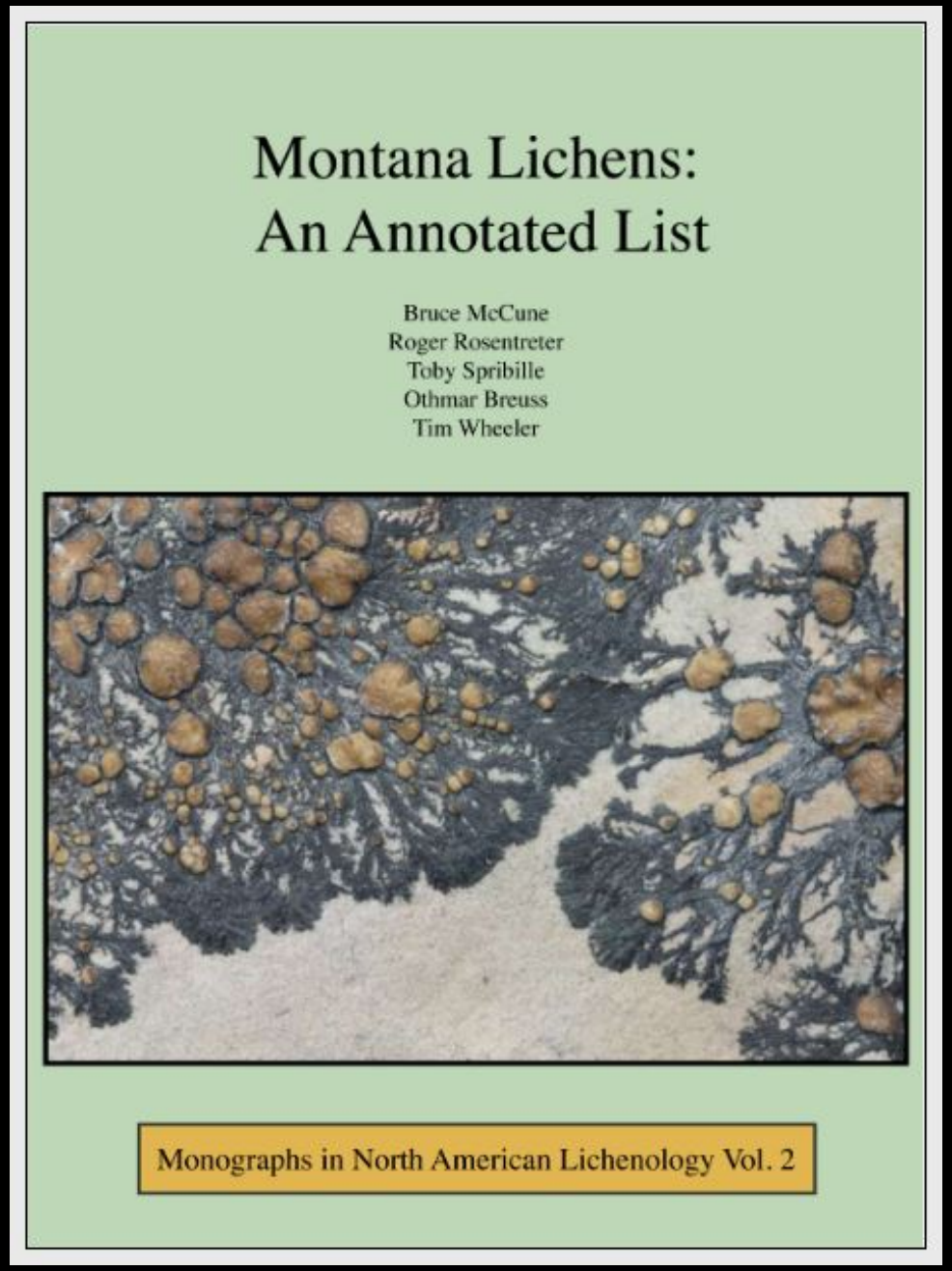
# CONDUCTING THE FIRST NON-VASCULAR SURVEYS IN MUSSELLSHELL COUNTY, MONTANA

by Andrea Pipp
Montana Natural Heritage Program Botanist




*2014*

*by*

Bruce McCune
Roger Rosentreter
Toby Spribille
Othmar Breuss
Tim Wheeler

# Montana Lichens: An Annotated List

Bruce McCune
Roger Rosentreter
Toby Spribille
Othmar Breuss
Tim Wheeler

Monographs in North American Lichenology Vol. 2

# SECOND CHECKLIST OF MONTANA MOSSES (DRAFT)

May 18, 1993

Prepared by:
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Bill & Dan Milton
Mussellshell County, Montana

Bill & Dana Milton
meals & lodging

Montana / Dakotas
BLM
Wendy Velman
Data Processing

Montana Natural Heritage Program
Andrea Pipp & Wildfire Wanderning
Logistics & more!

MONTANA NATIVE PLANT SOCIETY

Montana Native Plant Society
Travel Costs

Daphne Stone

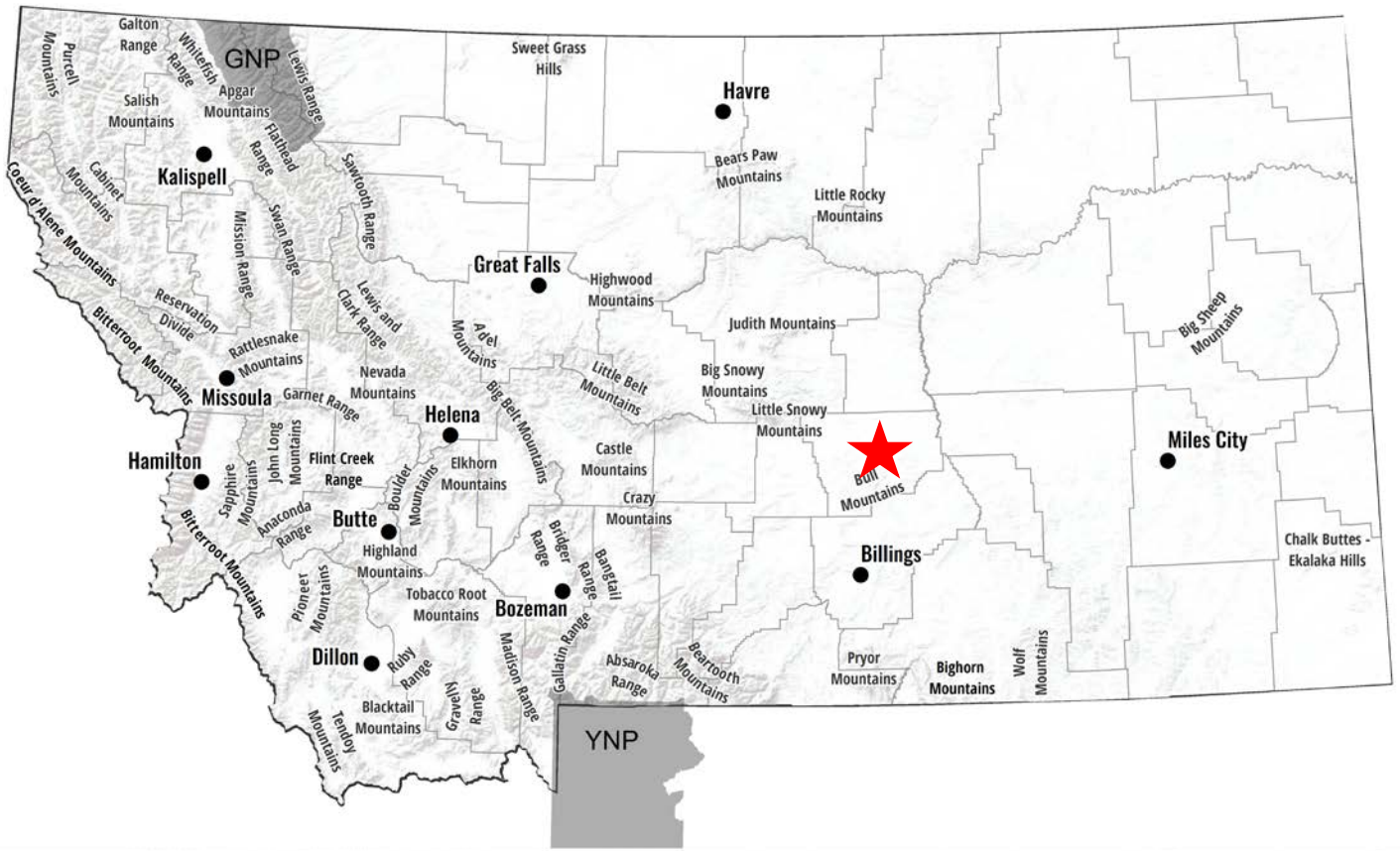
Bruce McCune

Ann DeBolt

Rob Smith

Katherine
Glew

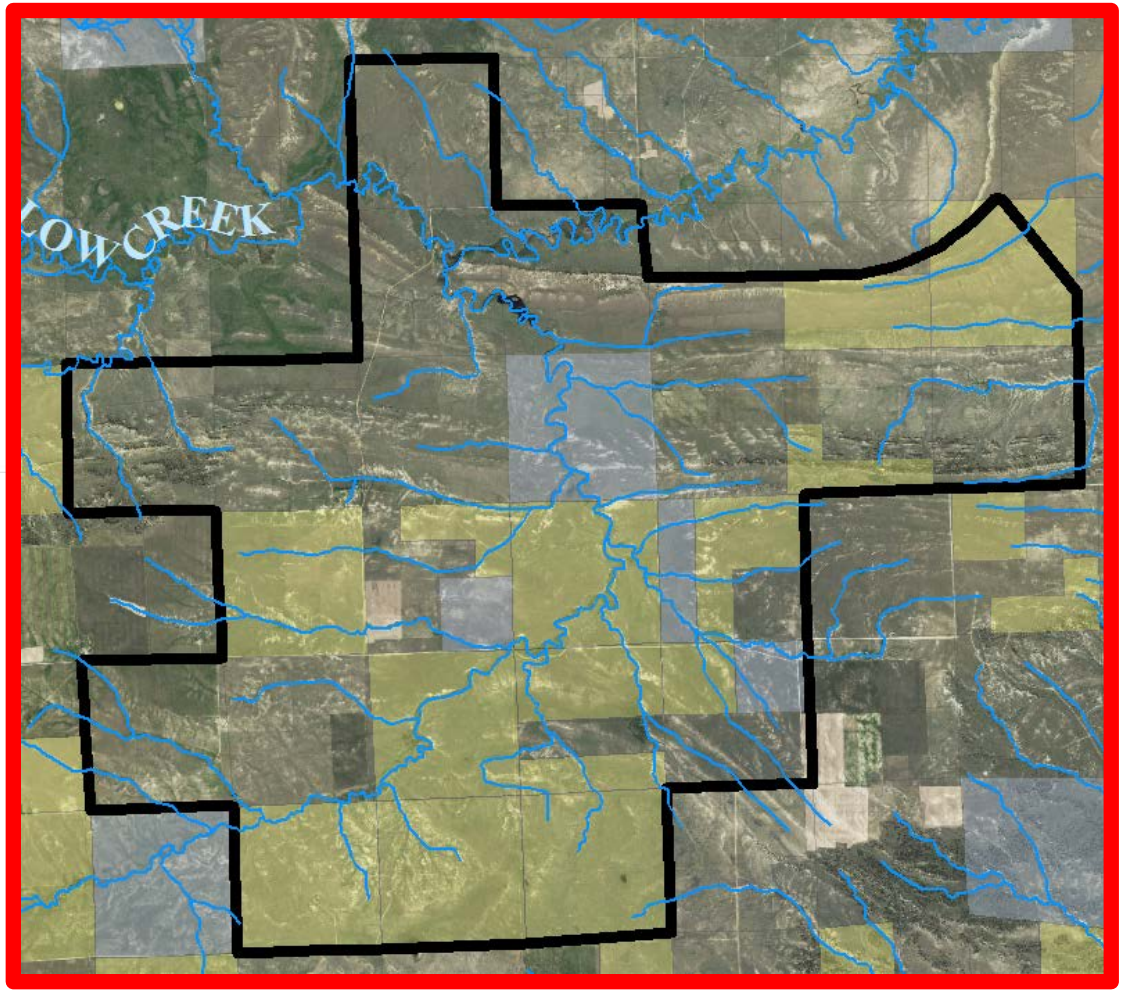
Roger
Rosentreter




# MONTANA

## Mussellshell County

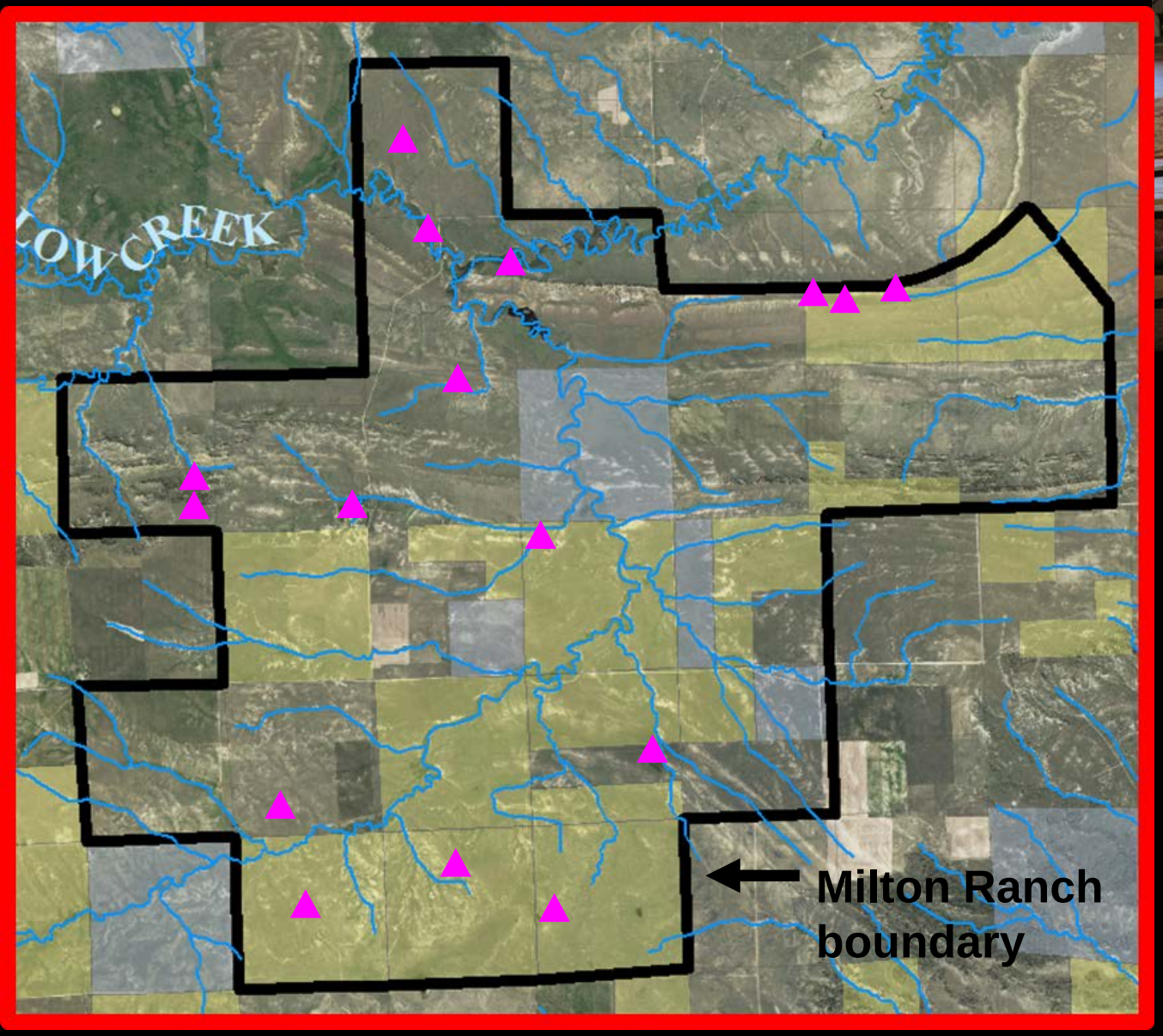
Milton Ranch - northeast of Roundup



## GOALS

- Survey all substrates for mosses and lichens
  - soil, wood, bark, rock, & aquatic
- Sample a variety of habitats, geography, & ownerships.
- Document species with latitude/longitude locations, population, substrate, habitat, and micro-site data
- Document species with verified specimens
  - University of Montana herbarium
- Photograph species for Montana Field Guide: http://fieldguide.mt.gov/
- Test in Montana the use of the Ground Layer Indicator for Rangelands

# September 13-15, 2016




## Morning Surveys & Afternoon / Evening Identifications

**Bryophytes** 27 Species

Expand All | Collapse All

| | Number of Observations | Species Occurrences |
|---|---|---|
| **Bryophytes - Barbula convoluta** *(Convoluted Beard Moss)* REVIEW | 1 | * |
| **Bryophytes - Brachytheciastrum collinum** *(A Mat Moss)* | 2 | * |
| **Bryophytes - Brachytheciastrum velutinum** *(Velvet Moss)* | 3 | * |
| **Bryophytes - Bryum argenteum** *(Silvery Bryum Moss)* | 1 | * |
| **Bryophytes - Ceratodon purpureus** *(Purple Horn-Tooth Moss)* | 1 | * |
| **Bryophytes - Didymodon fallax** *(A Lime Moss)* | 3 | * |
| **Bryophytes - Didymodon tectorum** *(A Lime Moss)* | 1 | * |
| **Bryophytes - Encalypta vulgaris** *(An Extinguisher Moss)* | 1 | * |
| **Bryophytes - Gemmabryum caespiticium** *(Tufted Gemmabryum Moss)* | 6 | * |
| **Bryophytes - Gemmabryum kunzei** *(Kunz's Bryum)* | 1 | * |
| **Bryophytes - Grimmia anodon** *(A Dry Rock Moss)* | 3 | * |
| **Bryophytes - Grimmia plagiopodia** *(A Dry Rock Moss)* | 1 | * |
| **Bryophytes - Hypnum cupressiforme** *(A Fern Moss)* | 1 | * |
| **Bryophytes - Hypnum vaucheri** *(A Fern Moss)* | 6 | * |
| **Bryophytes - Jaffueliobryum wrightii** *(A Jaffueliobryum Moss)* | 7 | * |
| **Bryophytes - Myurella julacea** *(Small Mousetail Moss)* | 2 | * |
| **Bryophytes - Pseudocrossidium obtusulum** *(A Pseudocrossidium Moss)* SOC | 1 | 1 |
| **Bryophytes - Pseudoleskeella tectorum** *(Rooftop Pseudoleskeella Moss)* | 7 | * |
| **Bryophytes - Pterygoneurum ovatum** *(A Pterynoneurum Moss)* | 1 | * |
| **Bryophytes - Pterygoneurum subsessile** *(Sessile Pterygoneurum Moss)* REVIEW | 1 | * |
| **Bryophytes - Pylaisia polyantha** *(Fertile Pylaisia)* | 2 | * |
| **Bryophytes - Syntrichia caninervis** *(A Syntrichia Moss)* REVIEW | 1 | * |
| **Bryophytes - Syntrichia papillosissima** *(Antler Twist Moss)* SOC | 5 | 5 |
| **Bryophytes - Syntrichia ruralis** *(Starry Syntrichia Moss)* | 20 | * |
| **Bryophytes - Tortella alpicola** *(A Tortella Moss)* | 3 | * |
| **Bryophytes - Tortula hoppeana** *(A Tortella Moss)* | 4 | * |
| **Bryophytes - Tortula mucronifolia** *(Mucron-leaf Tortula Moss)* | 1 | * |

# MOSS SURVEY RESULTS

≈ 97 moss observations
- 27 moss species found
- 86 specimens at MONTU

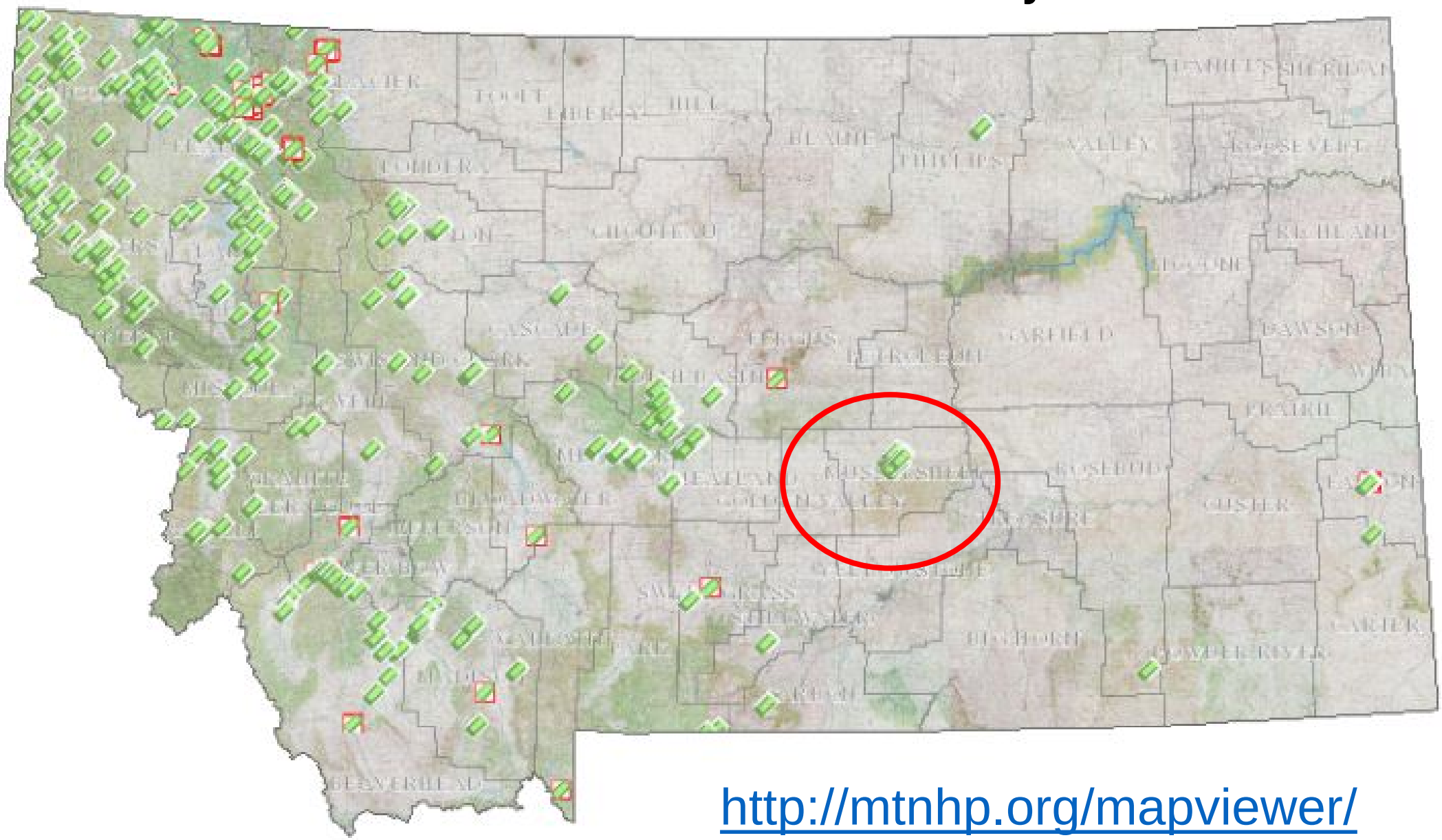
Top 5 commonly collected:
- *Syntrichia ruralis*
- *Jaffueliobryum wrightii*
- Pseudoleskella tectorum
- Gemmabryum caespiticium
- *Hypnum vaucheri*

Montana Species of Concern (SOC)
- *Syntrichia pappilosissima*

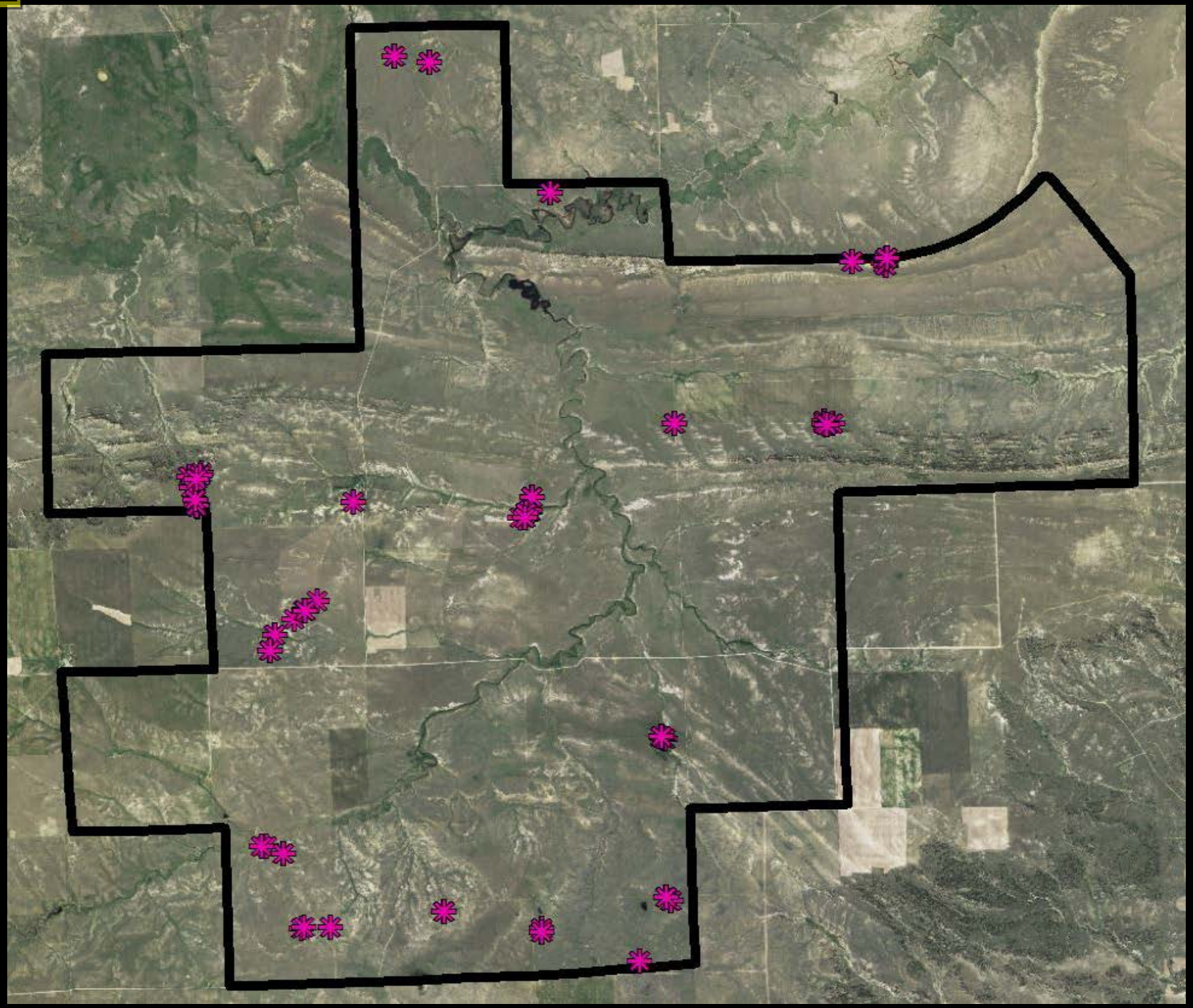
1st Montana Records
- *Didymodon tectorum*
- *Gemmabryum kunzei*

2nd Montana Record & SOC
- *Pseudocrossidium obtusulum*

# Moss Observations in the MTNHP Botany Database



http://mtnhp.org/mapviewer/



# LICHEN SURVEY RESULTS

≈ 395 lichen observations
- 117 lichen species found
- specimens to go to MONTU

Top 8 commonly collected:

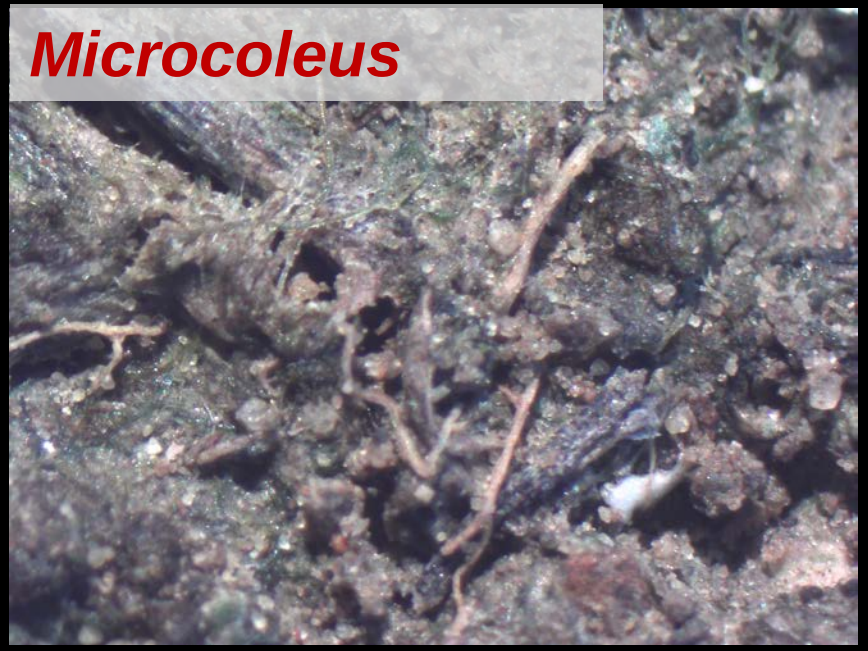
- *Xanthoparmelia chlorochroa*
- *Cladonia pocillum*
- *Enchylium tenax*
- *Xanthoparmelia camtschadalis*
- *Circinaria hispida*
- *Placidium rufescens*
- *Phaeophyscia constipata*
- *Diploschistes muscorum*

1st Montana Records

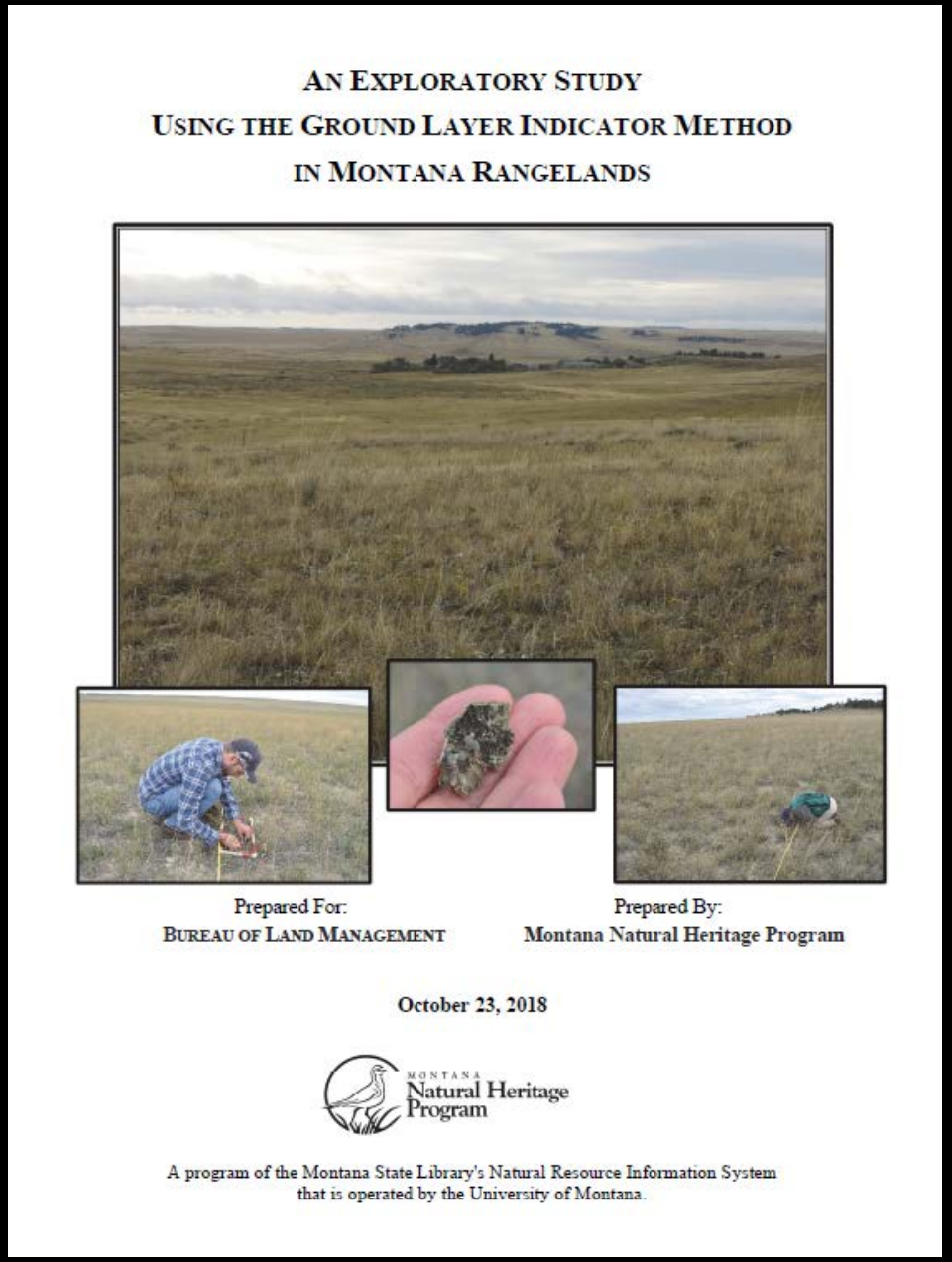
- Baglierroa calciseda (Verrucaria calciseda)
- Cladonia imbricarica? (upon TLC test)
- Collema crispum (Blennothallia crispa)
- Rinodina albertana
- Usnea diplotypus
- Xanthoparmelia neowyomingica

# CYANOBACTERIA



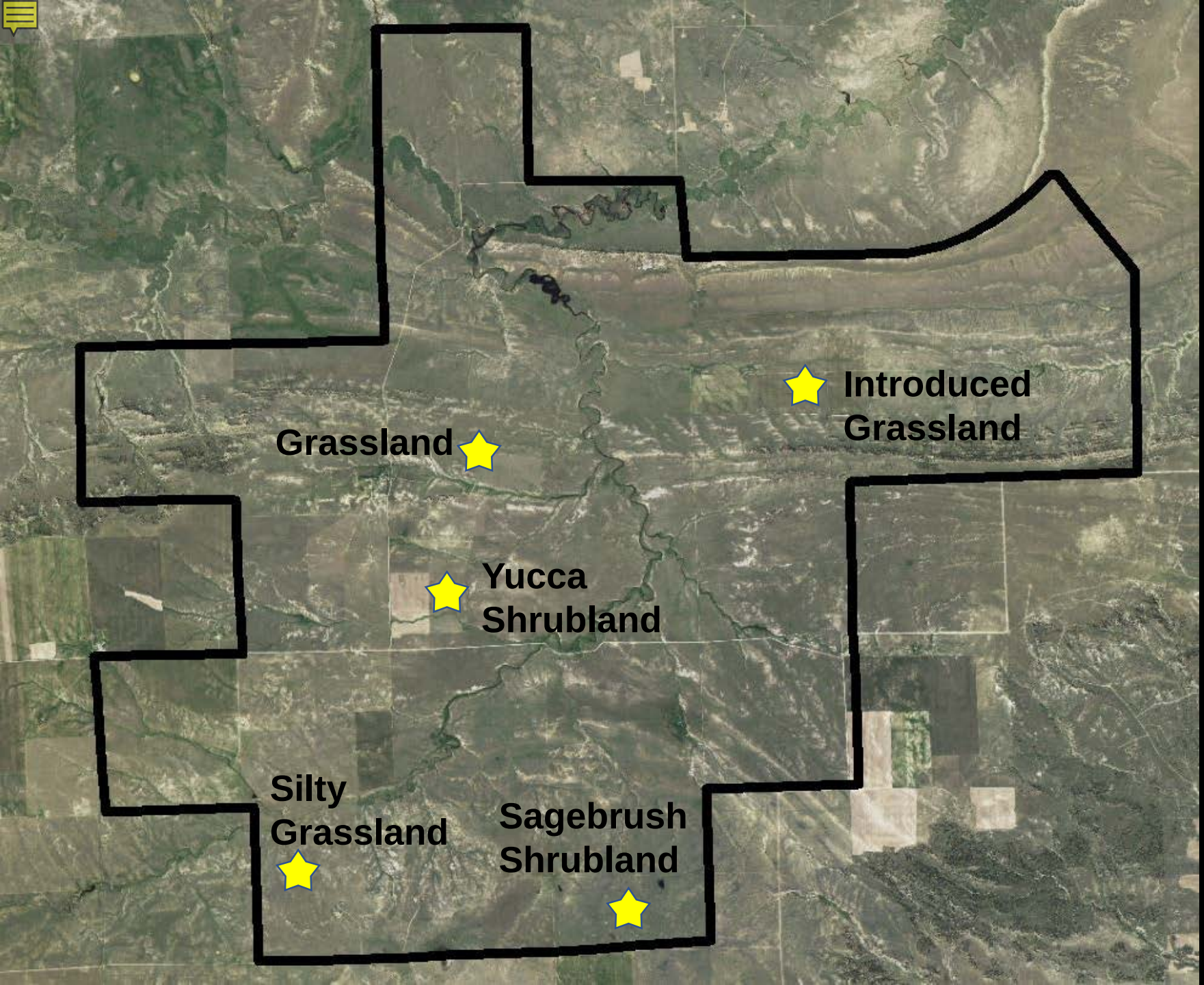



http://mtnhp.org/reports.asp




# Ground Layer Indicator for Rangelands in Montana

- Smith et al. 2015: Ground Layer Indicator method is a modification of the USFS Forest Inventory Analysis (FIA) for use on land with <10% tree cover.
- non-destructive method
- Assesses the Ground Layer community
  - bryophytes, lichens, cyanobacteria, micro-fungi, & algae
  - growing on soil [biological soil crust], wood, rock, & dead organic matter
- Uses ground layer functional groups, not species, to estimate biomass, carbon sequestration, & nitrogen content

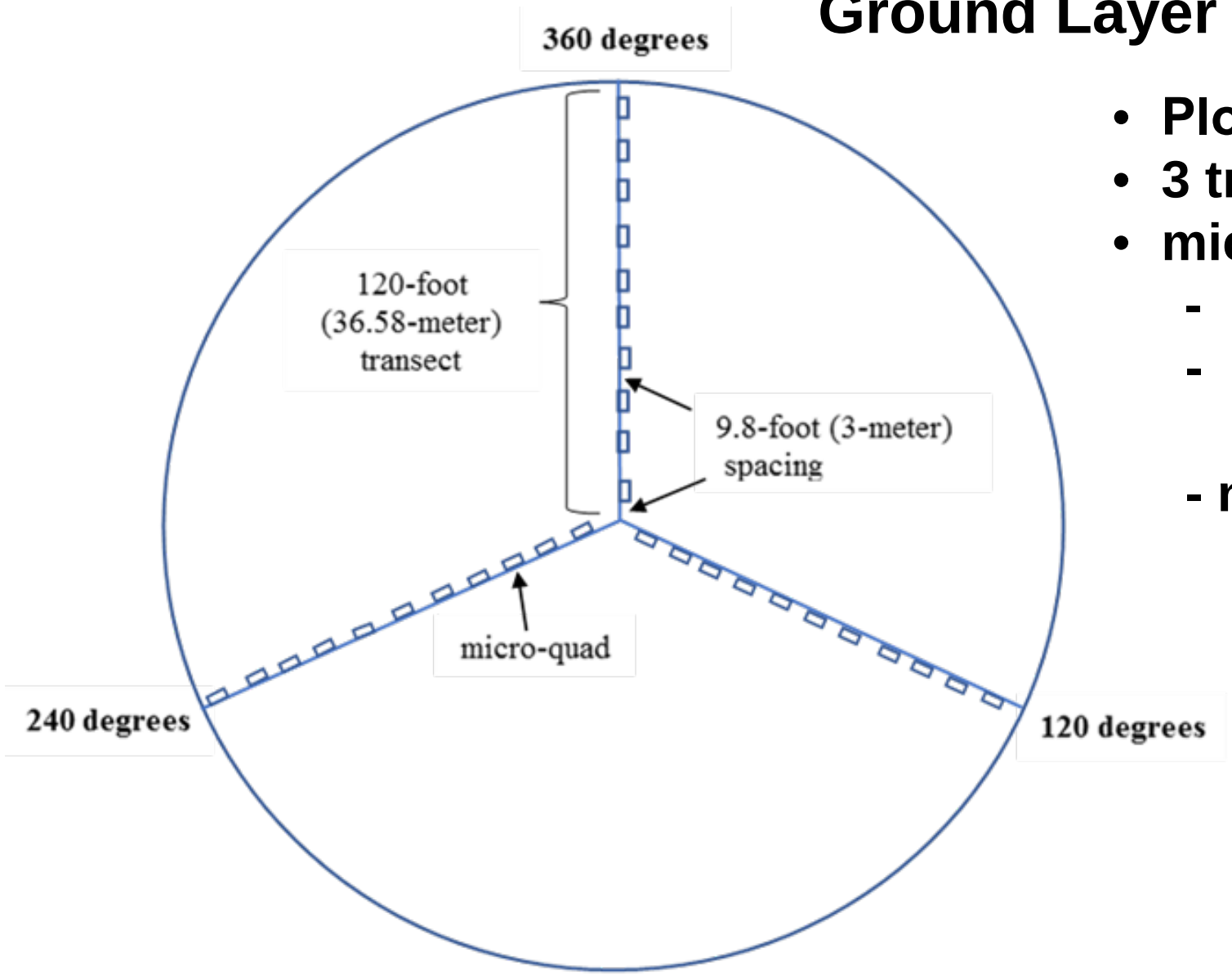



# Ground Layer Indicator for Rangelands

September 13-15, 2016

- 5 plots

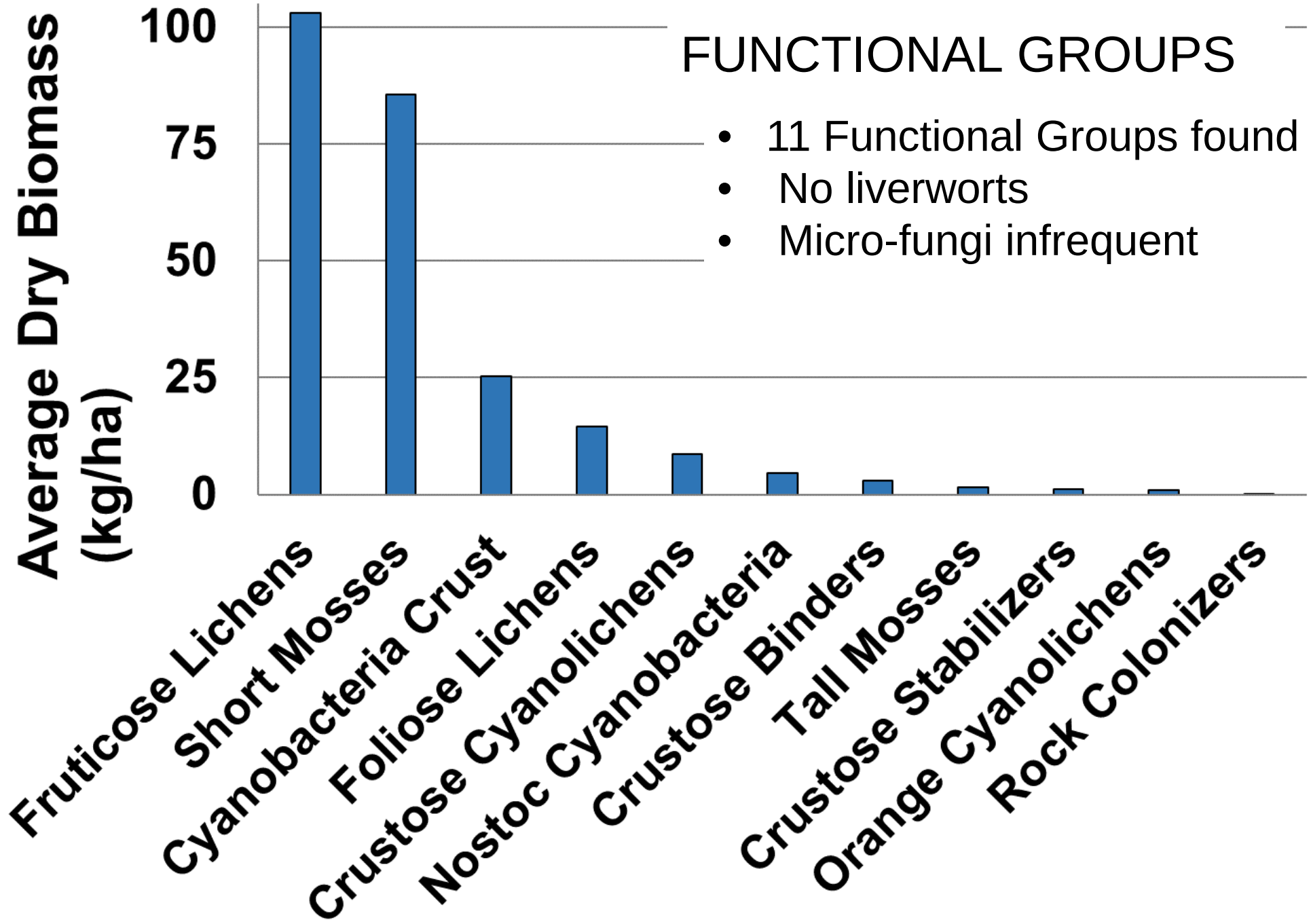
# Ground Layer Indicator for Rangelands




- **Plot ≈ 1 acre**
- **3 transects w/ 32 microquads**
- **microquad**
  - **20 x 50 cm**
  - **Percent Cover & Depth of each Functional Group**
- **no destructive sampling**

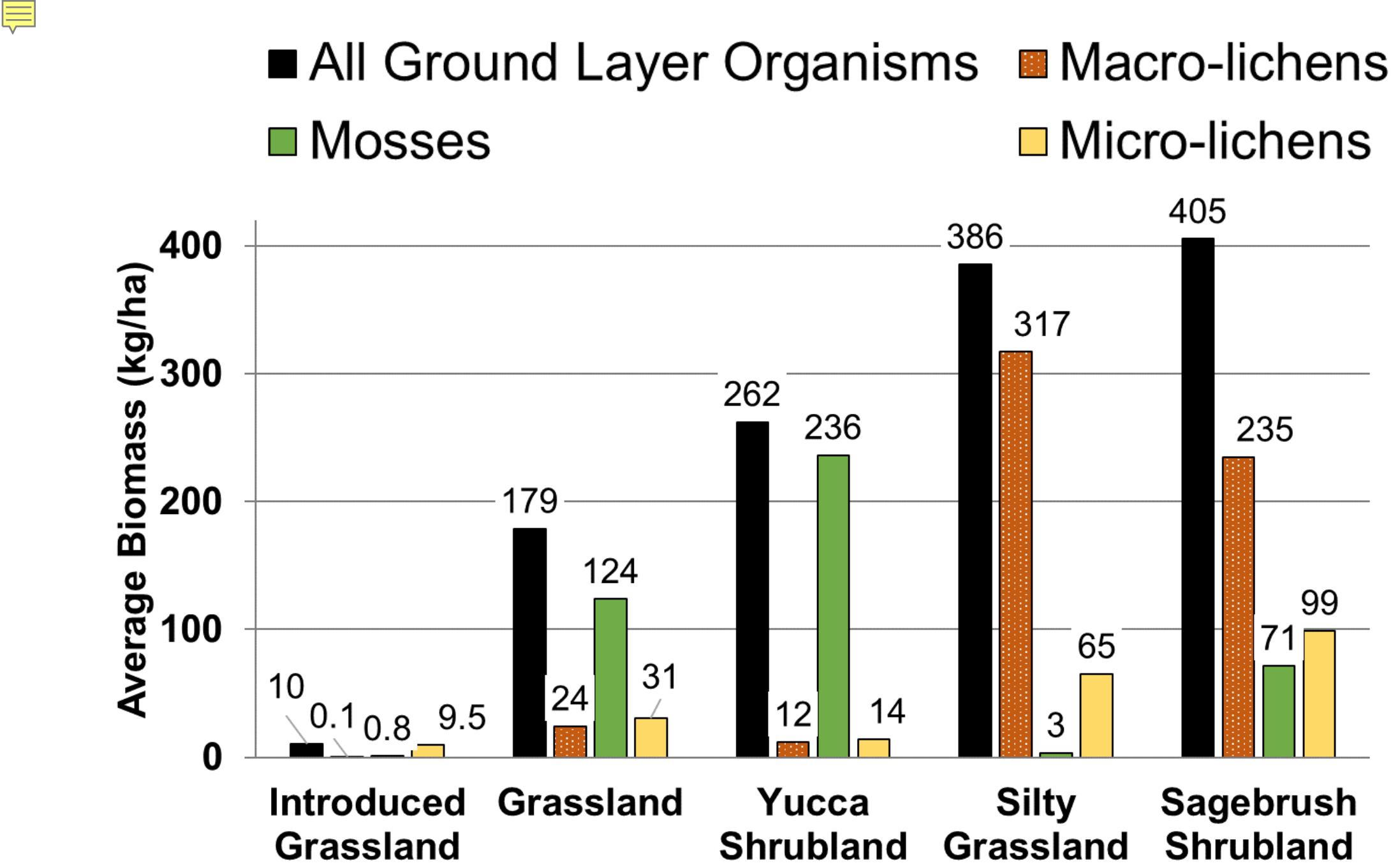
<u>GOAL</u>

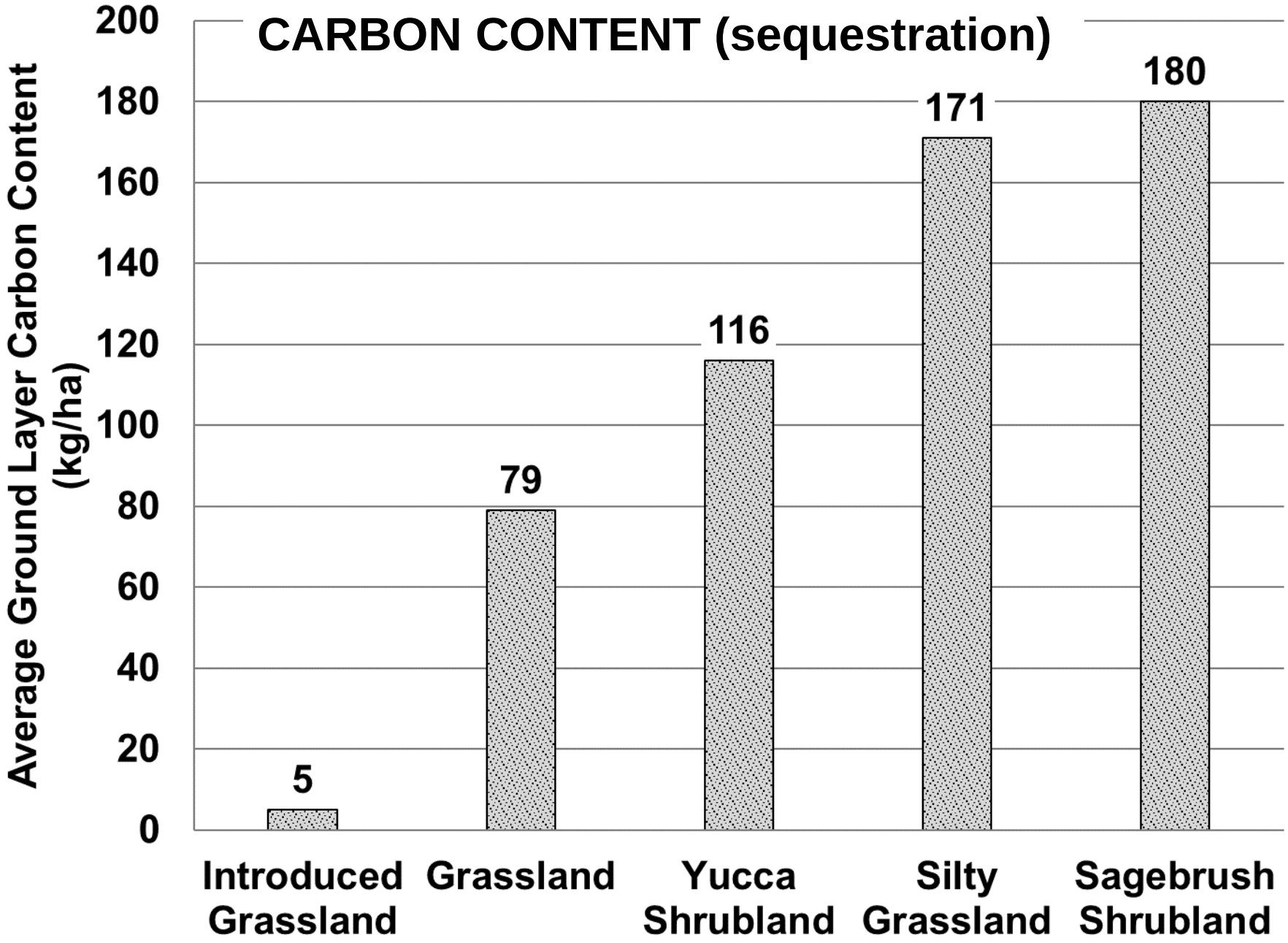
Accurately quantify volume and density of ground layer to estimate biomass, carbon and nitrogen contents.

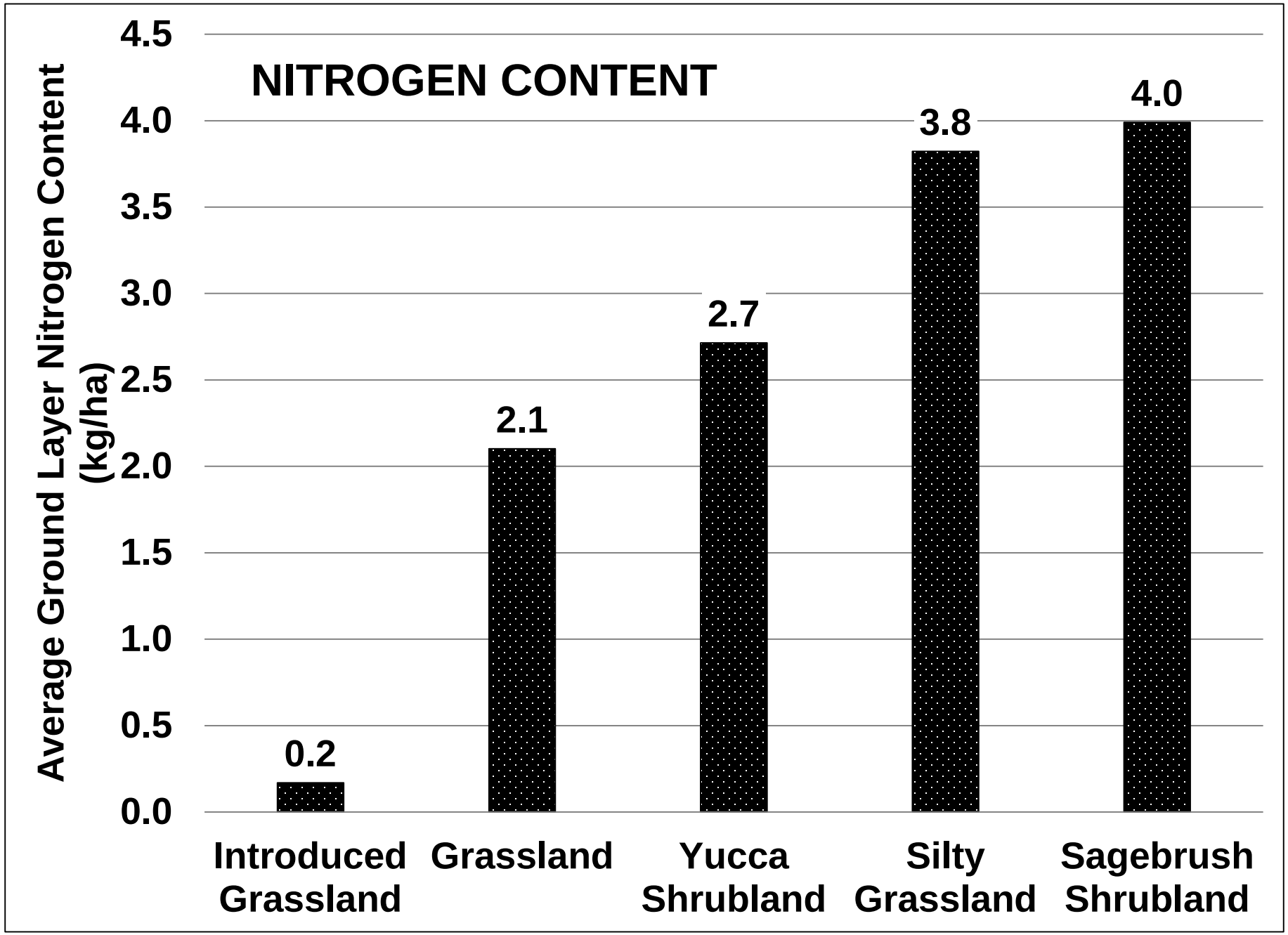


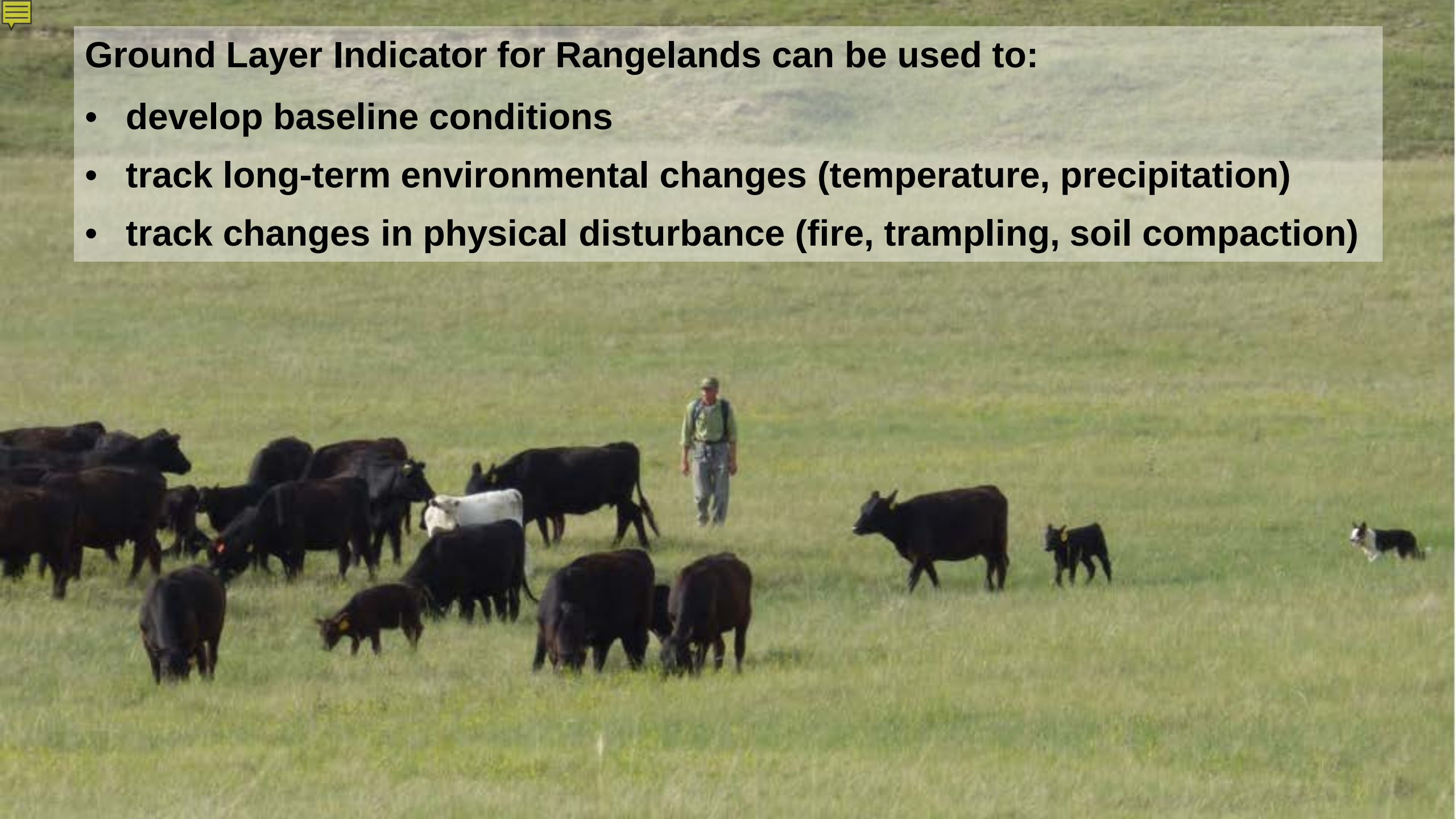

# FUNCTIONAL GROUPS

- 11 Functional Groups found on 5 plots
- No liverworts
- Micro-fungi infrequent


All Ground Layer Organisms
Macro-lichens
Mosses
Micro-lichens
Average Biomass (kg/ha)
400
300
200
100
0
10
0.1
0.8
9.5
179
24
124
31
262
12
236
14
386
3
317
65
405
235
71
99
Introduced Grassland
Grassland
Yucca Shrubland
Silty Grassland
Sagebrush Shrubland


CARBON CONTENT (sequestration)
Average Ground Layer Carbon Content (kg/ha)
200
180
160
140
120
100
80
60
40
20
0
5
79
116
171
180
Introduced Grassland
Grassland
Yucca Shrubland
Silty Grassland
Sagebrush Shrubland

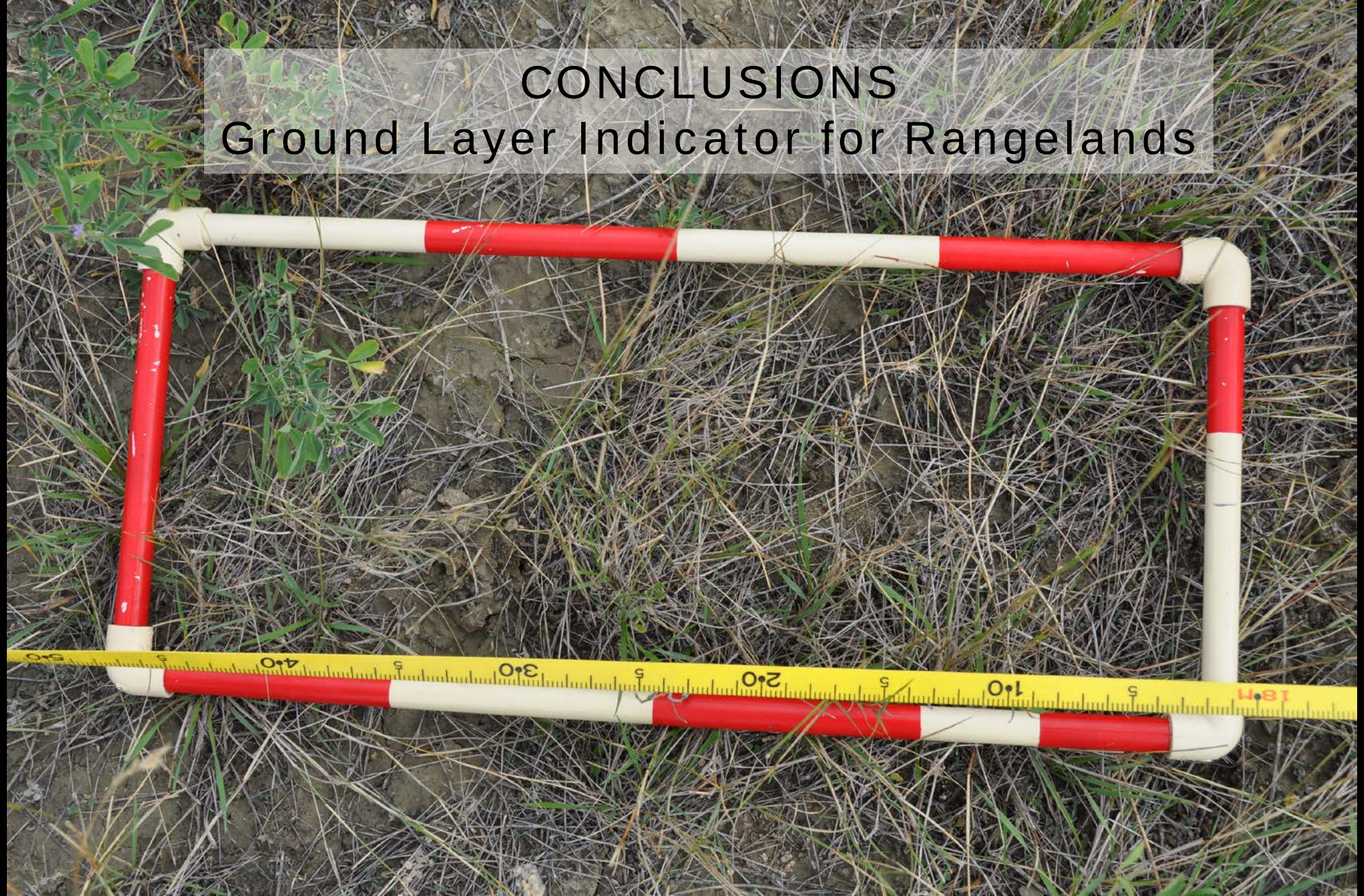

NITROGEN CONTENT
Average Ground Layer Nitrogen Content (kg/ha)
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0.2
2.1
2.7
3.8
4.0
Introduced Grassland
Grassland
Yucca Shrubland
Silty Grassland
Sagebrush Shrubland



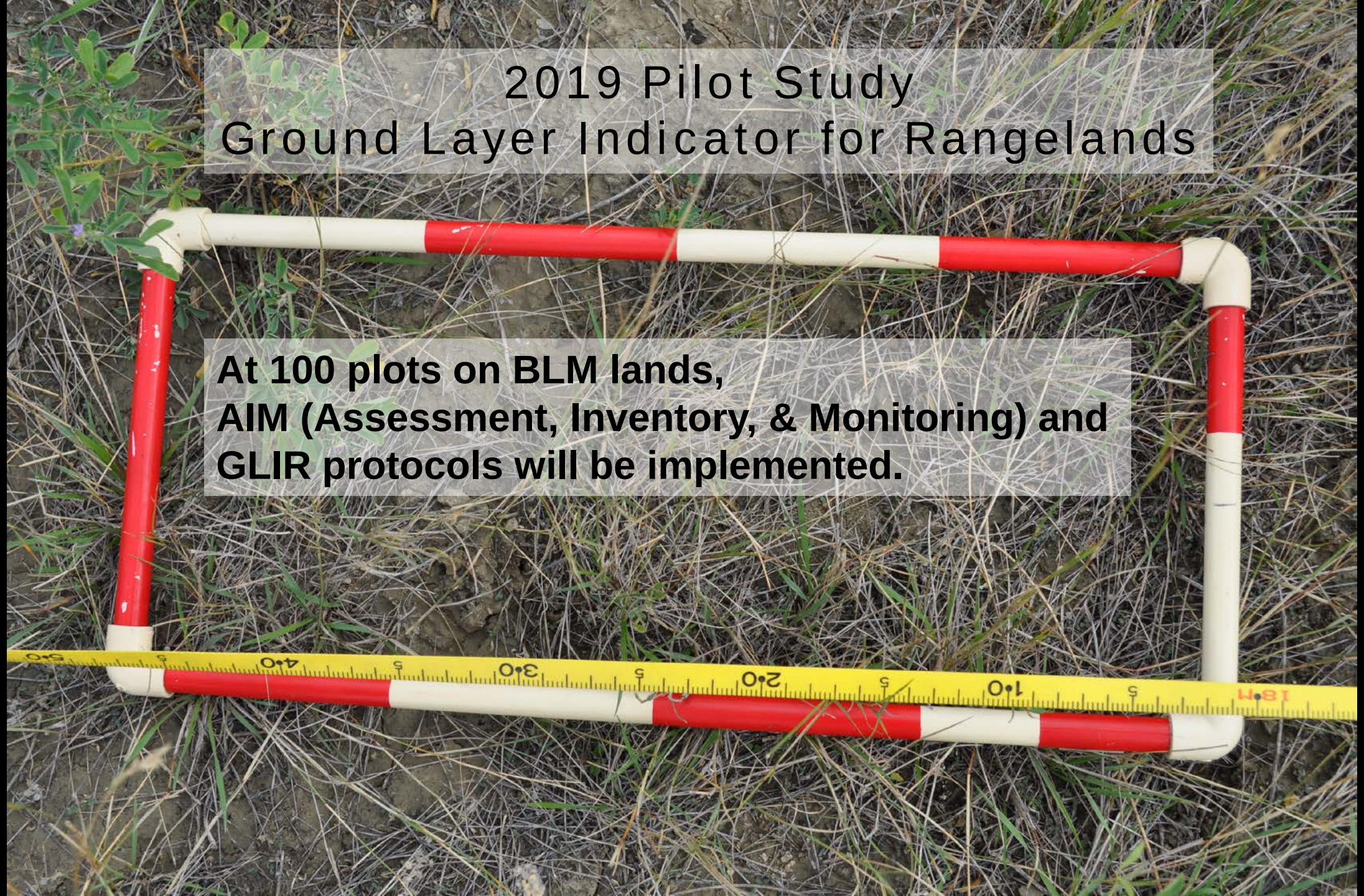
**Ground Layer Indicator for Rangelands can be used to:**

- **develop baseline conditions**
- **track long-term environmental changes (temperature, precipitation)**
- **track changes in physical disturbance (fire, trampling, soil compaction)**

# CONCLUSIONS
## Ground Layer Indicator for Rangelands



# 2019 Pilot Study
# Ground Layer Indicator for Rangelands



**At 100 plots on BLM lands,**
**AIM (Assessment, Inventory, & Monitoring) and**
**GLIR protocols will be implemented.**

mt.gov
Montana's Official State Website

MONTANA Natural Heritage Program

# MONTANA NATURAL HERITAGE PROGRAM

Home | Animals | Plants | Ecology | Wetlands | Publications | Data | About | Quick Data

Google Custom Sea Search

http://mtnhp.org/

## Announcements

- 2017 Conservationist of the Year Award
- Make your own Custom Field Guide
- Submit Plant Observations - new spreadsheet
- Updates to wetland status map
- Webinar: MT Field Guide
- 2015-2020 Strategic Plan
- New Species Snapshot app
- Vascular Plants Checklist
- Birds of Montana Checklist

## Employment

View Open Positions

- **Seasonal Ecological Monitoring staff** for rangeland and aquatic surveys during the summer of 2019
- **Postdoctoral Research Associate** with experience in remote sensing, large dataset handling, and ecology

## Montana Natural Heritage Program

- Species Snapshot
- Montana Field Guide
- Natural Heritage MapViewer
- Species of Concern Report - Animals
- Species of Concern Report - Plants
- Animal Info
- Plant Info
- Ecology Info
- Aquatic Info
- Wetlands Info
- Land Management Mapping
- Submit Observations
- Request Info

### A Montana Species of Concern


**White-faced Ibis** *Plegadis chihi*
Image from the **Montana Field Guide**

## Our Partners

- **Montana State Library**
- **University of Montana**
- **Natural Resource Information System**
- **NatureServe**

We're part of a **network** of over 80 Natural Heritage Programs that share data through **NatureServe.** Find species and ecological data for North America at **NatureServe Explorer.**

The Natural Heritage Program provides information on Montana's species and habitats, emphasizing those of conservation concern.

mt.gov
Montana's Official State Website

MONTANA FIELD GUIDE

Field Guide Home | Animals | Plants | Lichens | Ecological Systems | Invasives | Help

Select Language


## Montana Field Guides

Search Field Guide
Advanced Search
Go

**Animals**
*Multicellular organisms that develop from the fertilization of an egg by a sperm. Heterotrophic - obtain food by ingestion.*

**Plants**
*Multicellular organisms that are autotrophic or make complex carbohydrates from basic constituents. Most use photosynthesis.*

**Fungi** Lichens, Mushrooms, Molds, Yeasts, Chytrids
*Multi- or single-celled organisms that have chitin in their cell walls, reproduce by spores, do not photosynthesize, and acquire food primarily by secreting digestive enzymes into their environment. Some fungi, called Lichens, develop symbiotic relationships with green algae and/or cyanobacteria.*

**Ecological Systems**
*Ecological systems represent recurring groups of biological communities that are found in similar physical environments and are influenced by similar dynamic ecological processes, such as fire or flooding. Human Land Use classes are also shown here because they're included in the Montana Land Cover layer.*

**Invasive and Pest Species**
*Species not native to a specific location, which has a tendency to spread to a degree believed to cause damage to the environment, human economy, or human health.*

Welcome to our Montana Field Guides. These guides and this website are a collaborative effort between the Montana Natural Heritage Program and Montana Fish, Wildlife and Parks. These guides provide information on the identification, distribution, status, and ecology of Montana's animals, plants, lichens, and biological communities. You can find individual species or habitats by hierarchical drill downs or simple searches. New features include the ability to view galleries of photos to assist with species identification and the ability to download custom field guides as PDF files.

Select a Field Guide to start browsing or use the Search.

Montana Natural Heritage Program
- Map Viewer
- Species Snapshot
- Animal SOC Report
- Plant SOC Report
- Wetlands Information

Stay Connected with MTNHP

Montana Fish, Wildlife & Parks
- Species of Concern
- Endangered Species
- Living With Wildlife
- Kids Guide

Discover Montana's Ecosystems!

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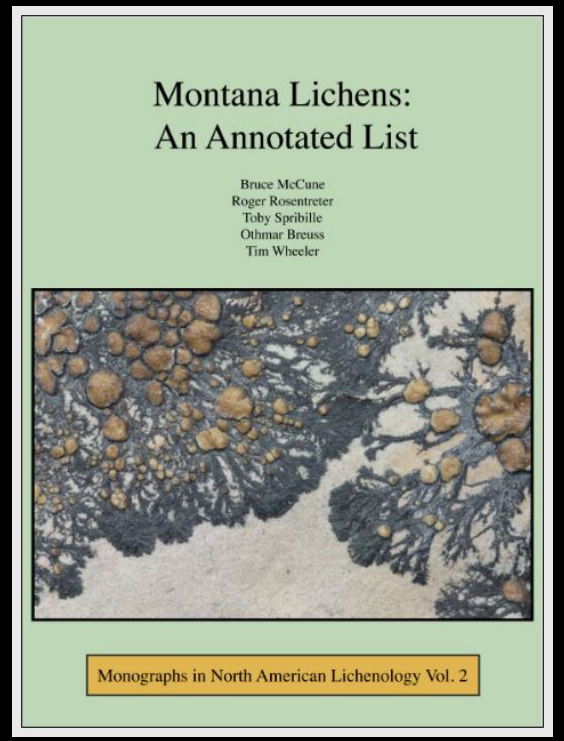
**Take us with you!**
Look for this PDF icon at the top of each page as you **search** and **browse**. You can download select species by searching or when you're on a Taxa page like Class, Order, and Family.

Here's some links if you want to download a whole group.

**Mammals**

# http://fieldguide.mt.gov/

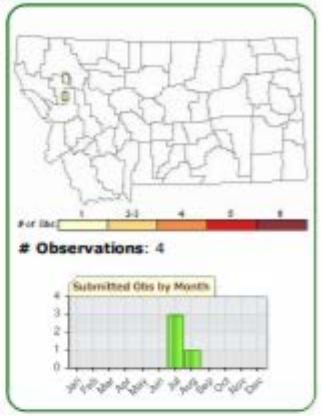


## Netted Lungwort Lichen
*Lobaria anomala*

View in Field Guide


Species of Concern
Native Species
Global Rank: G2G4
State Rank: S1

Agency Status
USFWS:
USFS:
BLM:
MNPS Threat Rank:




### General Description

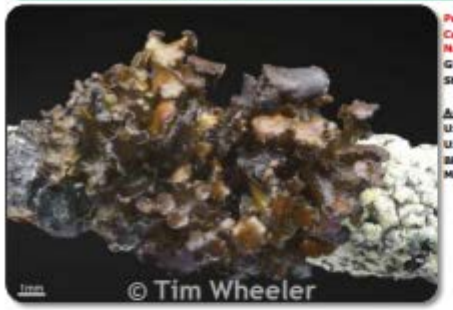
Thallus foliose, loosely appressed, free at the edges, to 20(40) cm broad; lobes mostly 1-3 cm broad; upper surface light or dark brown, with a network of ridges; lower surface covered with light brown tomentum with scattered white spots (pseudocyphellae); photobiont blue-green; soralia roundish to irregular, white, gray, or blue-gray, mainly on the ridges; apothecia brown, uncommon; and medulla white (McCune and Geiser 2009). Chemistry: Cortex K-; Medulla K+ yellow, P+ orange, or spot tests negative (McCune and Geiser 2009).

### Habitat

Generally on deciduous trees and shrubs; occasionally on coniferous trees; rarely on rock.

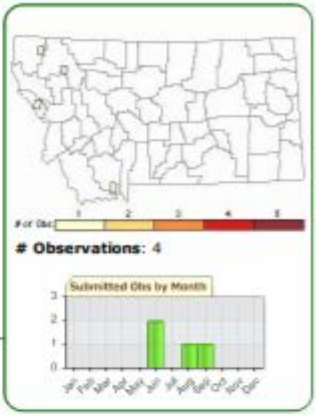
## Chestnut Wrinkled Lichen
*Cetraria sepincola*

View in Field Guide




Potential Species of Concern
Native Species
Global Rank: G5
State Rank: S2S3

Agency Status
USFWS:
USFS:
BLM:
MNPS Threat Rank:




### General Description

Thallus foliose, suberect to ascending, light to dark brown or pale olive, to less than 2 cm broad; lobes 2-3 cm wide with undulating margins; soredia and isidia lacking, and apothecia numerous, dominating the thallus McCune and Geiser 2009.

### Habitat

Generally on shrub twigs, especially those of Betula, in fens and bogs.

# A CHECKLIST OF MONTANA MOSSES (1880–2018)

*December 21, 2018*

Joe C. Elliott
Conservation Biology Research, Missoula, Montana

Andrea K. Pipp
Montana Natural Heritage Program, 1515 E Sixth Ave, Helena, Montana 59601

## Introduction

Montana has one of the richest recorded moss floras of the western United States (Eckel et al. 1997), even though large areas of the state remain under surveyed. The *Flora of North America* (FNA) volumes 27 (2007) and 28 (2014) include 1,402 species found in the continental United States, Canada, Greenland, and St. Pierre and Miquelon, of which 508 species have been recorded in Montana. Including varieties and subspecies, Montana has 522 moss taxa. The rich moss flora is due to the habitat and climatic diversity across the state and a long history of bryological exploration that began in the late 1800s.

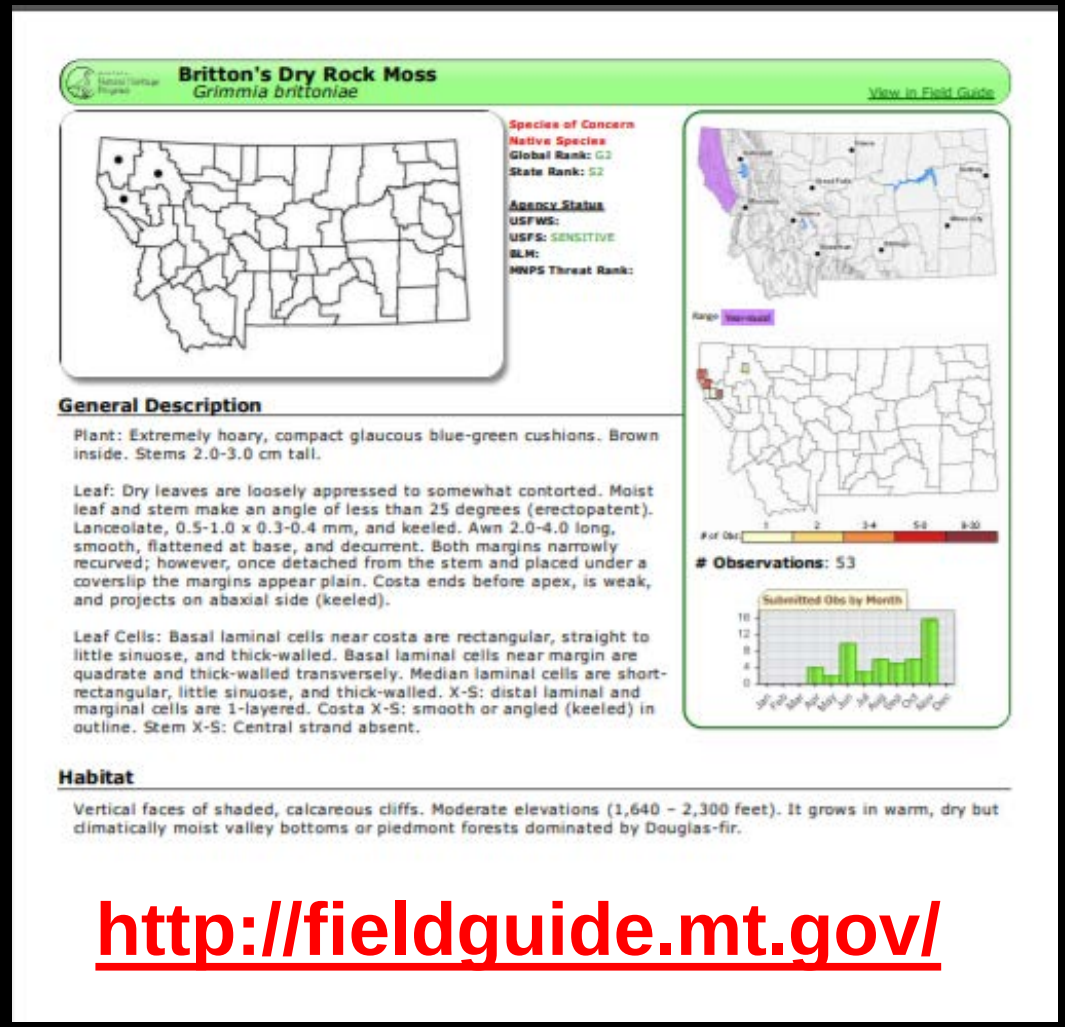
This checklist is a revision to the second preliminary checklist (Elliott 1993), which listed 408 taxa. The substantial increase in the number of moss taxa since 1993 indicates that, as in much of the western United States, our knowledge of the Montana moss flora continues to expand with increased field and herbarium studies. The discovery of mosses in eastern North America appears to be reaching saturation, but this is not true for western North America, where the accumulation of new species has continued to rise steeply over the last three decades (Carter et al. 2016).

Another publication, "History, Biogeography, and Species of Montana Mosses (1880-2018)" will be published in Evansia, a peer-reviewed quarterly of The American Bryological and Lichenological Society (expected June 2019).

## Methods

The primary author, Joe Elliott, examined collection records for mosses found in Montana and deposited in herbaria by searching the Consortium of Pacific Northwest Herbaria (CPNWH; www.pnwherbaria.org) and the Consortium for North American Bryophyte Herbaria (CNABH; http://bryophyteportal.org) databases from 2016 to 2017. Searches for scientific names and synonyms listed in FNA (2007, 2014) were conducted in 2016.

Collection records from herbaria that are not included in the CPNWH and CNABH databases were researched in 2016 and 2017. The University of Montana herbarium (MONTU) houses approximately 2,500 Montana specimens, and many from outside the state. During 2016 and 2017 Joe Elliott reviewed the entire MONTU moss collection to verify identifications and update nomenclature. A grant from the Institute of Museum and Library Services is allowing this collection to be digitized and geo-referenced with a project completion date of November 2019. The Yellowstone National Park herbarium (YELLO-HRC) houses collections of 289 taxa from Park and Gallatin Counties in Montana. Montana collections from the herbaria at the University of Alberta (ALTA) and Royal Alberta Museum (PMAE) in Edmonton also were reviewed.




**http://fieldguide.mt.gov/**

**History, Biogeography, and Species of Montana Mosses (1880-2018)**
***coming soon in Evansia***