Monitoring long-term soil moisture and alluvial storage response to upland thinning treatments

Data collection site at Burro Mountains project

Stiver Canyon alluvial drainage
Pinyon-juniper cover:
Saddlerock Canyon tributary, Burros Mountains
5500 ft. elevation
200 acres

Ponderosa-type cover:
Stiver Canyon, Gila River headwaters, Black Range
7700 ft. elevation
125 acres
Hypothesis:

Thinning converts brush → grass cover → increased watershed moisture storage capacity → enhanced capacity for long-term maintenance burning.

Goal:

Collect data on all aspects of watershed moisture to develop estimates of long-term moisture storage pre- and post-thinning.

Data collected:

Precipitation
Soil moisture (5-min intervals)
Alluvial groundwater levels (1-h intervals)
Temperature: soil and ambient
Soil type/bulk density
Vegetation cover, frequency, biomass (photogrammetry and OTG)
Weather station data: ET estimates

Baseline: 3 years
Post-treatment: 10+ years
Project participants

NRCS/Conservation Innovation Grants program
Grant SWCD
Black Range RC&D
Landowners/permittees
US Forest Service Gila N.F. (Silver City, Black Range, Wilderness Districts)
Interstate Stream Commission
New Mexico State University Climate Center
Audubon Society
NM State Forestry

Regular updates to all participants and other interested parties (e.g., NM Game & Fish); presentations at scheduled SWCD, RC&D meetings
Project history

- P-J project site, Burros Mountains: NRCS Conservation Innovation Grant funded initial instrumentation sets, 2007
  
  Four soil moisture (SMS) data collection sites, two piezometers, and recording rain gage established late 2007; soil samples and vegetation cover data collected early 2008

  ISC funded two additional SMS sites and weather station to collect data for ET estimates, spring 2008; NMSU Climate Center assistance

- Ponderosa-type site identified spring 2008

  ISC funds instrumentation and establishment of new site

  USFS Gila N.F. provides clearances, fall 2008

  Instrumentation placement scheduled Oct-Nov 2008

- NM State Forestry funding made available for treatments (2010-2011), summer 2008

- Audubon Society volunteer to conduct baseline bird counts, fall 2008-spring 2009
Instrumentation and Methods

- Recording soil moisture sensors (SMSs) and dataloggers
- Recording rain gage/temperature sensors /weather station
- Piezometers/recording pressure transducers
- Vegetation cover from aerial photography, transects/biomass plots
- Soil texture, salinity, bulk density
200-acre PJ project watershed

Site installations: 2007-2008
Baseline data collection: 2007-2010

Control and proposed prescription treatment, intensive treatment areas

Site D (4 SMs)
Site A (25 SMs)
Site E (4 SMs inc. deep)
Site C (4 SMs)
Rain gate
Penline
Weather station
Water level sensor
Peeled juniper treatment

Baseline data collection:

Control and proposed prescription treatment, intensive treatment areas

Burro Mt.edu project site as of April 2008

Prescription thinning: ~90% pinyon/non-allergenic juniper species; 0% alligator juniper/tack: ~100 acres
Total thinning, all woody brush species: ~35 acres
P Piezometer
125-acre ponderosa project area (3800-acre watershed)
Site instrumentation fall 2008  Baseline data collection: 2008 - 2011
Control sites; proposed near- and long-term treatment areas
Precipitation and typical 5-min soil moisture data from four sensors at Burros project site, January 2008 - April 2008

- Dripline
- Open
- “Toe”
- Canopy
Typical diurnal changes in soil moisture contents from four sensors at Burros project site, April 2008

- Dripline, canopy
Precipitation and hourly piezometer data, Dec. 2007 - April 2008

- Rapid groundwater response to precipitation and runoff
- Rate of groundwater decline attenuated below spring; total decline in groundwater levels less above spring
Basic cover and vegetation line-point intercept data from Burros project site, May 2008

Three lines per data collection site; randomly selected azimuths

Biomass plots to be established fall 2008
Data production and analyses

**ET data development**
Developed by NMSU Climate Center from transmitted weather station data for Burros site. Developed from algorithms used by NMSU for data downloaded from Stiver site

**Data analyses**
Correlation analyses: e.g., soil moisture v. precipitation, temperature, ET per site; per project area; per SMS placement
Examine factor or cluster analysis to identify strength of soil type/bulk density and/or vegetation cover/density effects on soil moisture
Conduct multiple regression/multivariate analyses based on results
Extrapolate to predictive models based on factors of highest explanatory value
Optimal needs

Additional study sites (geologic factors)

GIS component (analyses incorporating slope, aspect, environmental/climate factors)

Concurrent studies on long-term wildlife effects

Completely developed water chemistry component (stable isotope data/analysis)

Liaison and data sharing with similar studies

LONG-TERM COMMITMENT