***CBRLM Monitoring 2012 protocols (based on Riginos and Herrick 2010\*)***

# Soil Stability Test

1. Use 9 selected stick positions (N 1/2/4, E 2/4, S 2/4, W 2/4.)
2. **At selected sticks, step over the stick with the heel against the middle of the stick. Place the soil stability box (length wise) in front of the shoe tip and take samples.**
3. Excavate a small trench (10-15 mm deep) in front of the area to be sampled.
4. Lift out a soil fragment and trim it (if necessary) to the correct size. The soil fragment should be 2-3 mm thick and 6-8 mm in diameter. This is the diameter of a wood pencil eraser.
5. **Collect samples at the exact point. Move the sample point only if it has been disturbed during previous measurements or the soil surface is protected by a rock or embedded litter. Move the point a standard distance (1 box length in a random direction).**
6. Minimize shattering by: a) slicing the soil around the sample before lifting; b) lifting out a larger sample than required, and trimming it to size in the palm of your hand; or c) misting the sample area before collection.
7. If the soil sample is too weakly structured to sample (falls through the sieve), mist it lightly with deionized water (use an atomizer or equivalent) and then take a sample. Perfume and plastic hair spray bottles work well for this. If the sample still will not hold together, record a “1” on the data form.
8. **If the soil surface is covered by a lichen or cyanobacterial crust, include the crust in the sample.**
9. Gently place the sample in a dry sieve; place sieve in the appropriate cell of a dry box. Leave box lid open.
10. Collect a subsurface sample (optional, see Step 1).
11. Sample directly below the surface sample.
12. Use the flat, square (handle) end of the scoop to gently excavate the previous trench (in front of the surface sample) to a depth of 3-4 cm.
13. Directly below the surface sample, remove soil so that a “shelf” is created with the top step 2-2.5 cm below the soil surface.
14. Use the scoop to lift out a subsurface sample from below.
15. The soil fragment should be 2-3 mm thick and 6-8 mm in diameter.
16. Place the sample in a dry sieve; place sieve in a dry box. Leave box lid open.
17. Make sure the surface and subsurface samples are dry. **Samples must be dry before testing.** If samples are not dry after collecting, allow to air dry with the lid off.
18. Do not leave lid closed on samples for more than 1 minute on hot/sunny days. Excessive heat can artificially increase or decrease stability.
19. Fill the empty (no sieves) box with deionized or distilled water. Fill each compartment to the top. The water should be approximately the same temperature as the soil.
20. Test the samples:
    1. Lower the first sieve with the sample into the respective water-filled compartment—upper left corner of sample box to upper left corner of water box.
    2. From the time the sieve screen touches the water surface to the time it rests on the bottom of the box, 1 second should elapse.
    3. Start the stopwatch when the first sample touches the water. Use the Table to assign samples to stability classes.
    4. After five minutes, follow the sequence of immersions on the data form, adding one sample every 15 seconds. Beginners may want to immerse a sample every 30 seconds.
    5. This allows nine samples to be run in 10 minutes, so it takes 20 minutes to test one box of 18 samples. Observe the fragments from the time the sample hits the water to 5 min (300 sec) and record a stability class based on the Table.
    6. Raise the sieve completely out of the water and then lower it to the bottom without touching the bottom of the tray. Repeat this immersion a total of five times. Do this even if you have already rated the sample a 1, 2 or 3 (you are allowed to change your rating if after sieving, >10% of soil remains on sieve).
    7. **It should take 1 second for each sieve to clear the water’s surface and 1 second to return to near the bottom of the box.**
    8. Hydrophobic samples (float in water after pushed under) are rated 6.

**Stability Class Criteria for Assignment to Stability Class**

**1 - 50% of structural integrity lost (melts) within 5 seconds of immersion in water,**

**OR soil too unstable to sample (falls through sieve).**

**2 - 50% of structural integrity lost (melts) 5-30 seconds after immersion.**

**3 - 50% of structural integrity lost (melts) 30-300 seconds after immersion,**

**OR < 10% of soil remains on the sieve after five dipping cycles.**

**4 - 10–25% of soil remains on the sieve after five dipping cycles.**

**5 - 25–75% of soil remains on the sieve after five dipping cycles.**

**6 - 75–100 % of soil remains on the sieve after five dipping cycles.**

# Stick Method

1. Walk 5 m North in a straight line from the site’s center point.

2. Put down the stick 50 cm in front of your feet. Try not to look at where you are putting it. Try putting it as close to the ground as possible.

3. Record what type of plant and/or ground cover is present at each mark on the stick. **Choose the side of the stick farther from you.** **Record only the plant and ground cover that are immediately above or below that point on the edge of the stick.** Imagine that a raindrop is falling down directly onto that point: what does the raindrop hit on its way down?

4. For each point along the edge of the stick, decide what (if anything) is protecting the soil surface. Select the appropriate symbol on that point on the App datasheet:

a. If the point is on top of a rock, select the rock symbol ‘Rock’.

b. If there is nothing permanent covering the soil surface (no rock, litter or vegetation), do not mark that point on the stick diagram in any way.

5. For each point along the edge of the stick, decide what (if any) litter or plants are covering the ground at that point.

6. Plant and ground cover data tell you what percentage of the ground is covered by different types of plants, litter (unattached, dead plant material), rock, or not covered at all (bare ground).

7. Record only the plant and ground cover that are immediately above or below each mark on the stick.

# Definitions for Stick Categories:

**Rock:** any piece of rock or small stone that is more than 5 mm in diameter. Even these small stones protect the soil surface from the impact of raindrops.

**Herb litter:** any leaves, dung, seeds and pods.

**Wood litter:** unattached woody material, such as sticks, thorns, spines and logs.

**Annual grasses and forbs:** non-woody herbs and annual grasses.

**Perennial grasses:** the following traits may be observed – still green during the dry season, tuft contains grey carry-over material (from previous seasons) and is relatively large and difficult to pull out by hand, may be raised on pedestals.

**Short shrub:** woody plant with height below 50 cm (knee) above ground.

**Shrub (including small trees):** a woody plant where all live stems at 1.5 m height above ground are smaller than 7.5 cm in diameter.

**Tree:** a woody plant where at least one live stem at 1.5 m above ground is 7.5 cm in diameter or larger.

**Canopy over stick:** any plant part directly above the stick from 10 cm to 2 m height.

**Base over stick:** any plant base directly underneath the stick (10mm diameter). Plant base is defined as the horizontal area covered where the rooted aboveground plant parts meet the soil surface.

**Plant height:** the maximum height of any plant part directly above a one meter square directly in front (viewed from site center) of the stick.

**Perennial grass count:** number ofperennial grasses rooted with more than 50 % of tuft within a square meter directly in front of the stick. An individual tuft must have at least a finger width between perennial tuft bases. For creeping grasses, stolons are ignored and the finger test applied for rooted plant parts.

# Herbaceous Biomass Clipping

1. Clip only standing (attached) herbaceous plants approximately 1.5 cm above ground.
2. If necessary, remove litter to expose covered plants, but be careful with brittle annuals.
3. Make sure no litter is included in samples.
4. Weigh empty bag and tare scale. Place biomass in bag and record the actual biomass on tablet.
5. Mark the site name, the direction (NE, SE, SW, NW) and the net mass (tare scale with empty bag before weighing biomass) clearly on bag.
6. Place bag directly to the right of quadrat with written information clearly visible and take vertical photograph.

# Collection of Specimens

1. A specimen of WD1, WD2, HD1 and HD2 **must** be collected at each site.
2. Specimens must have flowers or seed.
3. Grasses must be pulled out and the entire plant taken as specimen.
4. Specimens are placed into brown paper bags (WD1 and HD1 into 1 bag; WD2 and HD2 into a 2nd bag).