

Development of biocrust restoration materials:

A strategy to transition from research object to shovel-ready



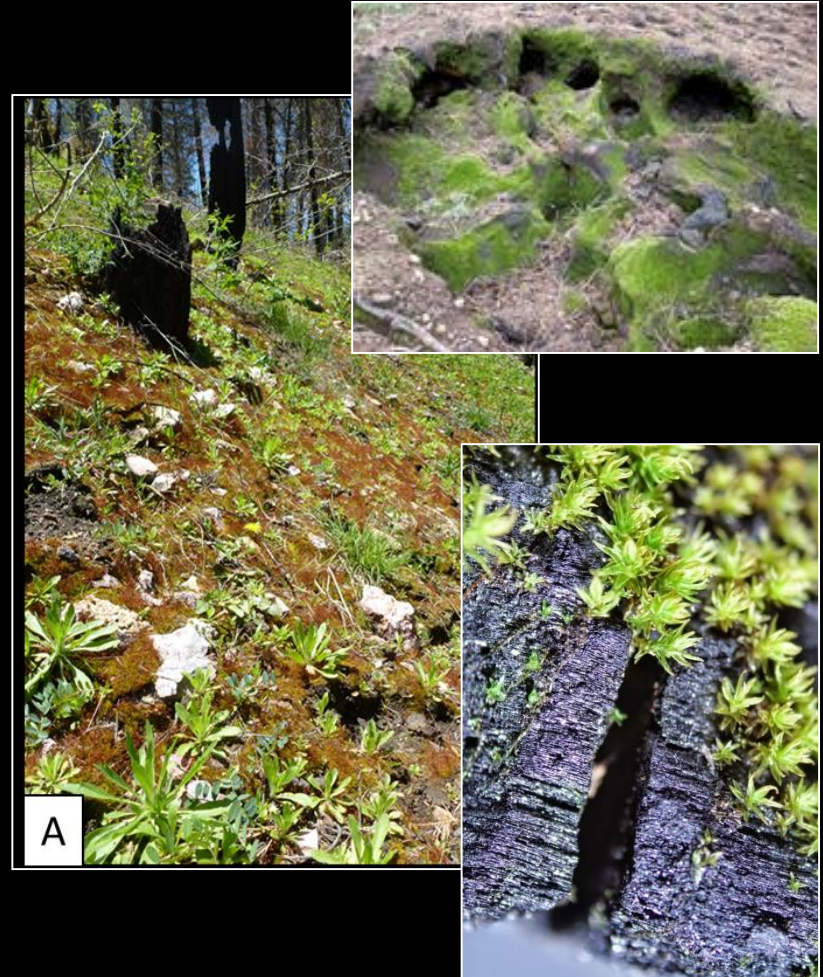
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Kyle D. Doherty

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We're working with biocrusts in 2 general settings:



Dryland biocrusts: cyanobacteria mosses & lichens common in grasslands, shrublands, woodlands of CP



Fire mosses: Bryophytes proliferating after fire in forests and steppes

We can grow biocrusts.

1. Develop
optimal
culturing
technique

Culturing biocrust vegetative material is analogous to seed increase (but with a longer “shelf-life”)

Goal: Grow ever more biomass faster, cheaper, or in less space

We can grow biocrusts.

The Research & Development pipeline

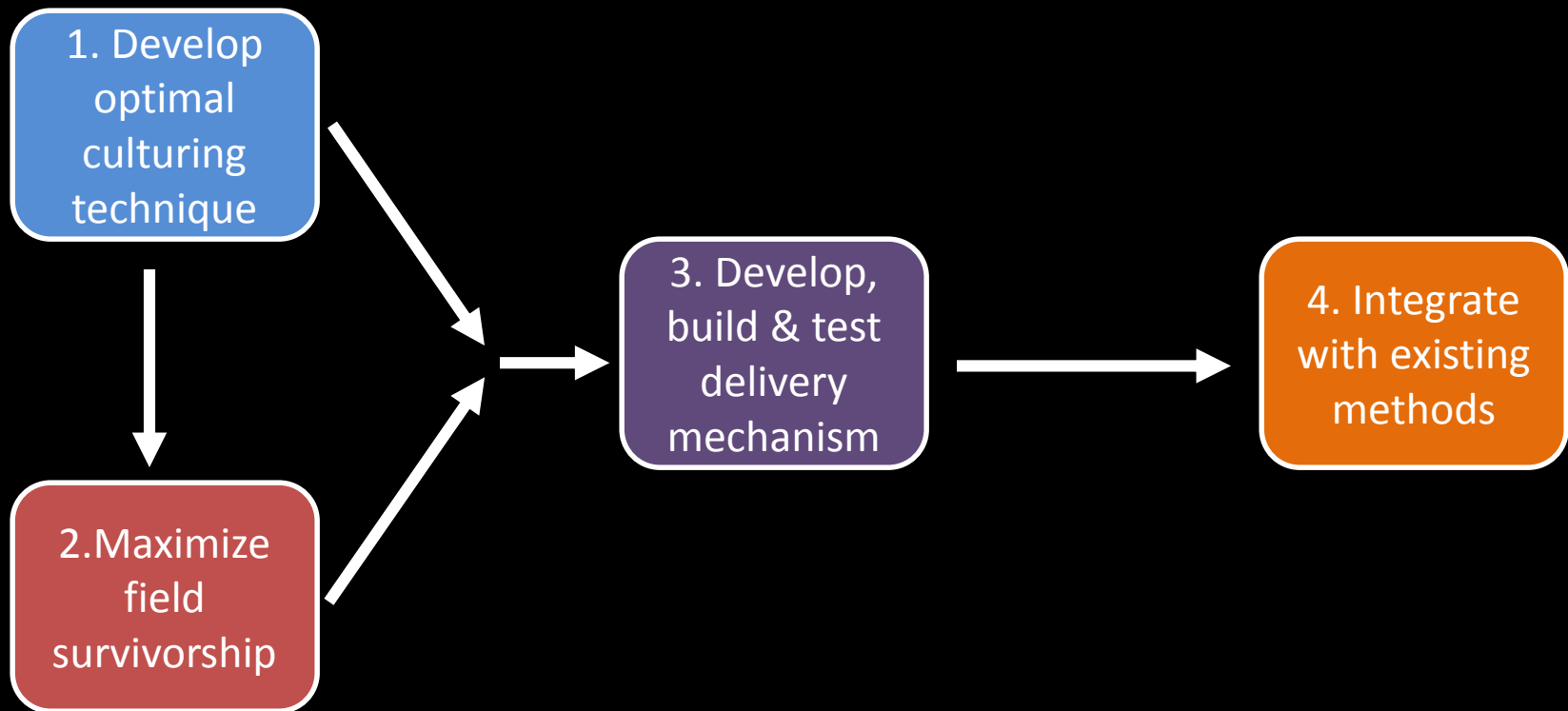
1. Develop
optimal
culturing
technique



2. Maximize
field
survivorship

We can grow biocrusts.

The Research & Development pipeline

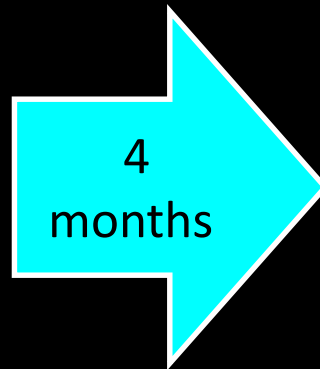


The “bryotron”

1. Develop
optimal
culturing
technique

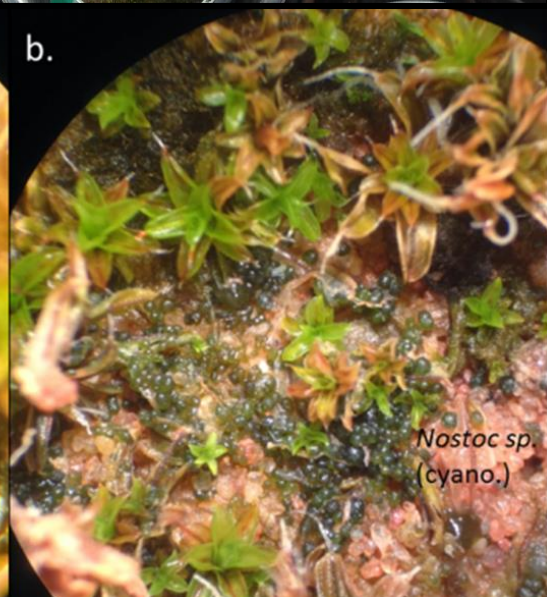
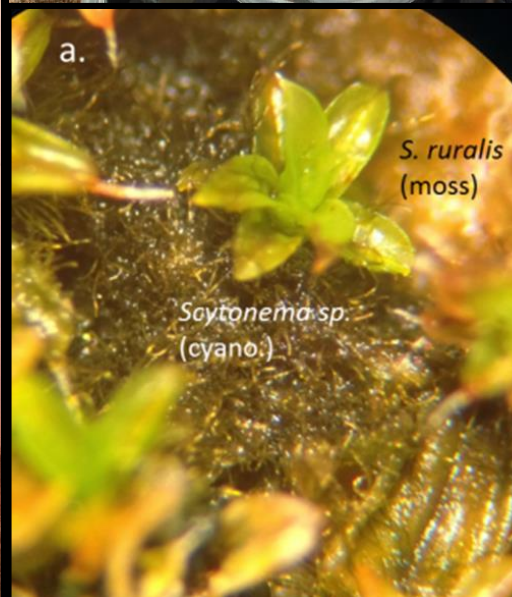


Developed by Kyle Doherty, Anita Antoninka



This is a mixture of N-fixing lichens
& cyanobacteria

Photos: K. Young, K. Doherty



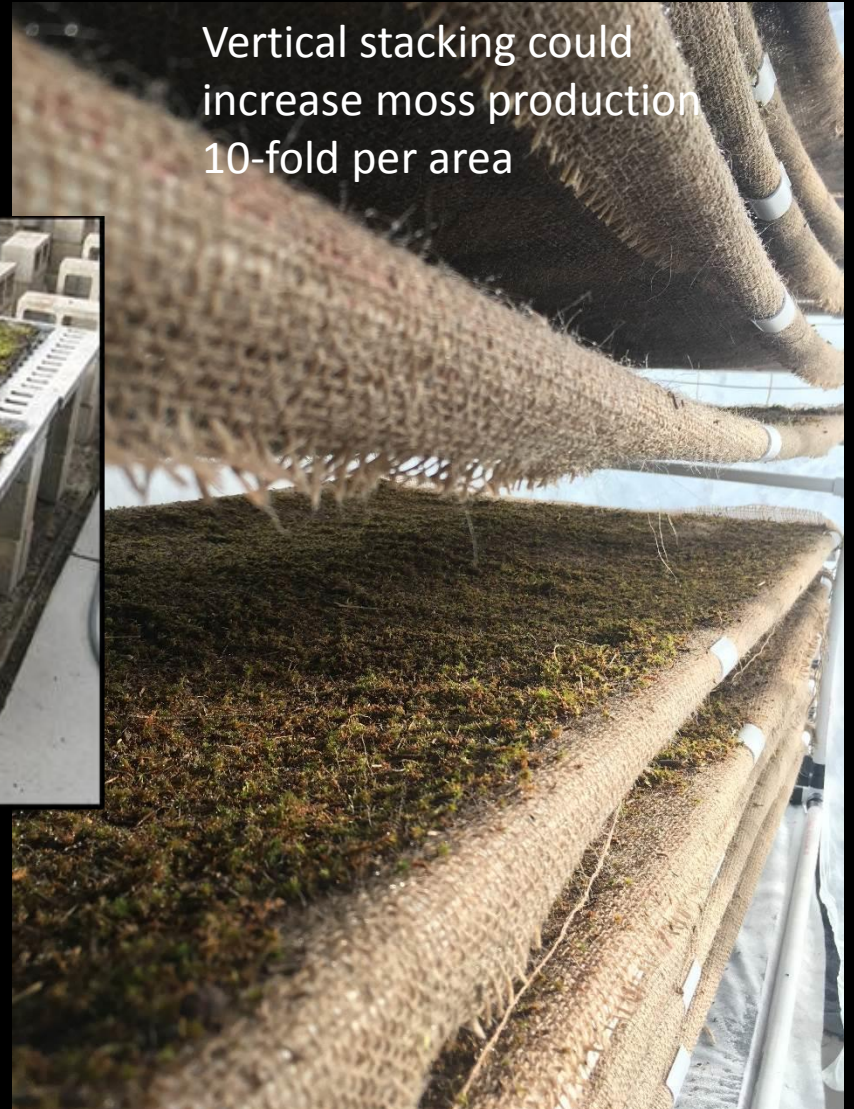
Ramping up “seed increase”

Fire moss: scaled up wicking method
Developed by Henry Grover



Could plausibly produce nearly 500 ft² of moss every 2 months

Vertical stacking could
increase moss production
10-fold per area



Fog system developed by Kyle Doherty

1. Develop
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Remaining hurdles



Size of greenhouse itself limits the scale of production

Greenhouse-reared organisms sometimes have a tough time later establishing in field

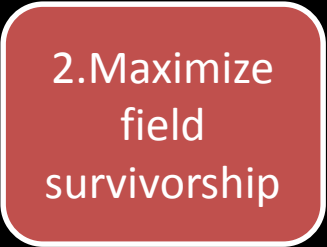
We can grow biocrusts.

Can we help them survive the field????

1. Develop
optimal
culturing
technique



2. Maximize
field
survivorship



Possibilities:

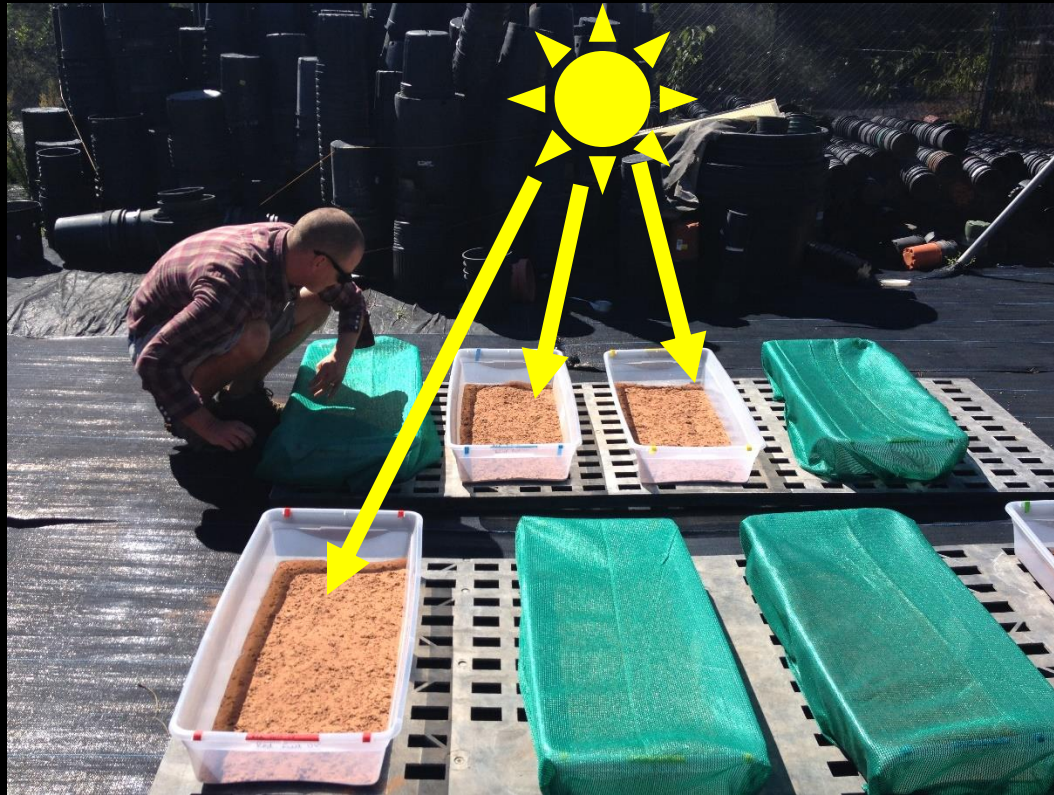
Optimize selection of genetic material

“hardening off” organisms before field delivery

Temporarily make environment more benign
shade, ground cover
deliver with protection

Proper timing of application

Testing “hardening”



Exposure to full spectrum
light while wet
(vs. shading)

High and low stress
water regimes

Tests of habitat amelioration...

Surface Roughening



Shade



Straw border-
erosion control



Jute cloth:
(kinda does all 3)

Tests of hardening & habitat amelioration (summary)*

Promising

Straw border

Surface roughening –
sometimes beneficial

Shade –
beneficial but
difficult to scale up

Polyacrilimides (4 types) –
some beneficial,
some not

Jute cloth

Pelletizing moss

Less so

Hardening –
weak, highly contingent
effect

1 time watering

Flashing

Wood slash

Vascular plant seeding

2 week watering

* Results vary site to site; this list always in flux

Our current fave:

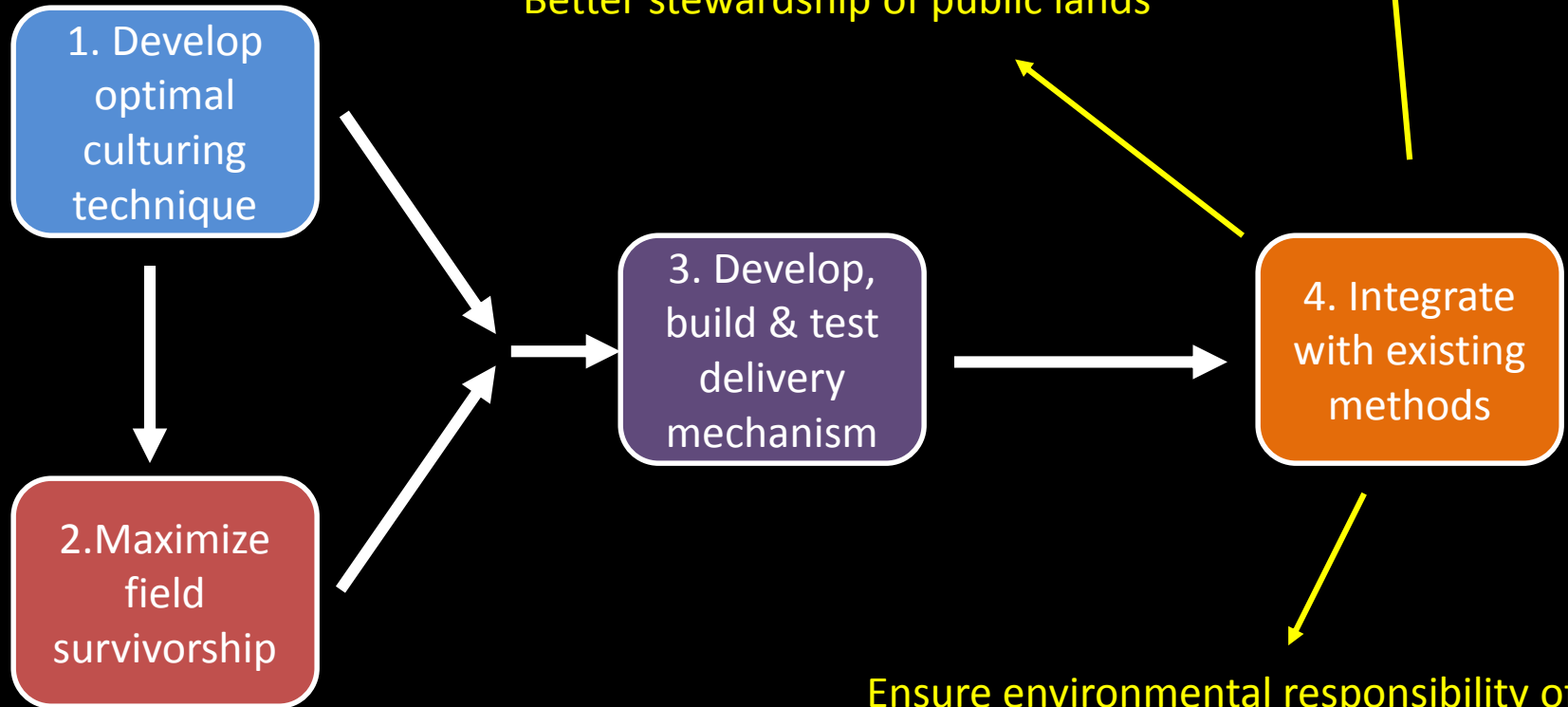
What if “seed” increase can be scaled up
& organisms hardened at the same time?



Outdoor growing systems being tested in Montana,
Nevada, Utah. Soon we'll add Washington.

New “seed” tech for managers

Better stewardship of public lands



Ensure environmental responsibility of:
energy/mineral extraction
traditional land uses
recreation
border security activity

Acknowledgments



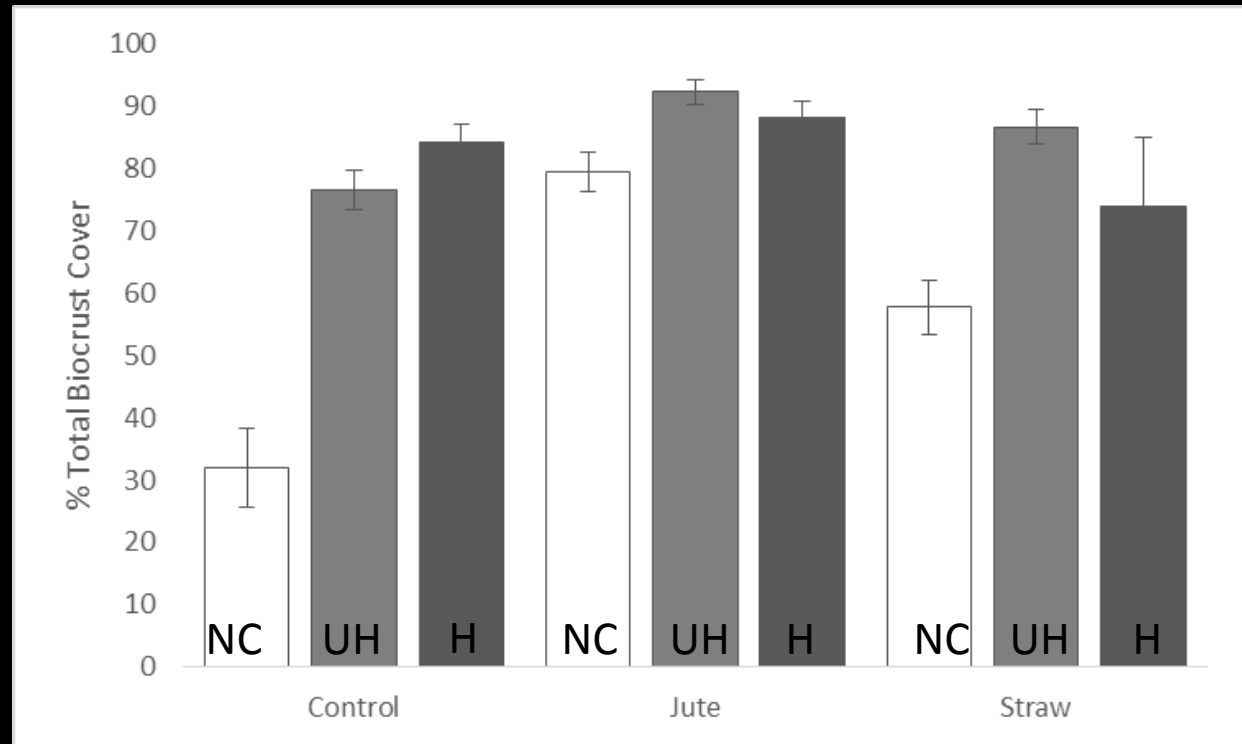
BLM partners & boosters past
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Wayne Padgett, Peggy Olwell,
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1. Hardening didn't matter
2. Water didn't help
3. Jute promotes visible biocrust cover



1. Hardening didn't matter
2. Water didn't help
3. Jute promotes visible biocrust cover
4. Straw better for stability

