REVEGETATION TRENDS AND LESSONS – MONTANA COAL

“The secret of managing is to keep the guys who hate you away from the guys who are undecided.“

Casey Stengel

“Can't anybody here play this game?“

Casey Stengel

MONKEY SEE – MONKEY DO

SPRING CREEK AND DECKER COAL MINES

TONGUE RIVER BASIN

SOUTH-CENTRAL MT

3500’ ELEV. (1,070 m)

10.8” (27 CM) ANNUAL PRECIP.

~ CLAY LOAM

3 SUBSTRATES: SPOIL, SCORIA, SALVAGED TOPSOIL

SCM HAS 9
MAJOR SEED MIXES
MAY USE SEVERAL IN ONE FIELD

E.G., 1 OR 2 UPLAND MIXES
ALLUVIAL MIX
SPECIAL SUBSTRATES
SHRUB MOSAICS

MONTANA COAL DISTURBANCE

63 mi² = 163 km²

0.2% OF CROPLAND

28,000 mi² = 73,000 km²

SMCRA 1977

REVEG. DIVERSE, EFFECTIVE, PERMANENT

NATIVE SPP. EXCEPT PASTURES

≥ PREMINE COVER AND PROD.

CONTROL EROSION

AFTER SMCRA

COAL BECAME THE CRUCIBLE FOR WESTERN REVEGETATION

MT COAL AND URANIUM MINE RECLAMATION LAW WEAKENED 2003

STILL REQUIRES A MINIMUM 10 YEAR TO EVALUATE PHASE 3 BOND RELEASE

Table 10. Shrub survival as a function of field age, Sodic Overburden Test Plots.

AGE (YRS.)	4’ Suitable Fill	8’ Suitable Fill
	----INDIV/HA (% SURVIVAL)---	
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11	2,460 (29)	2,520 (14)


2H T21
P.5
1000 days

Table 1. Premine (baseline) vegetational attributes, SCCM.

VEGETATION TYPE	PERENNIAL COVER %	PERENNIAL PSC KG/HA*	SHRUB DENSITY INDIV/HA**
Steppe Types (minor)	43	800	700
Sagebrush Types	48	625	8,400 (3,400/A)

* Air-dried; excluding tree productivity. Multiply by 0.89 for pounds/acre.

** For shrubs/acre divide by 2.47.

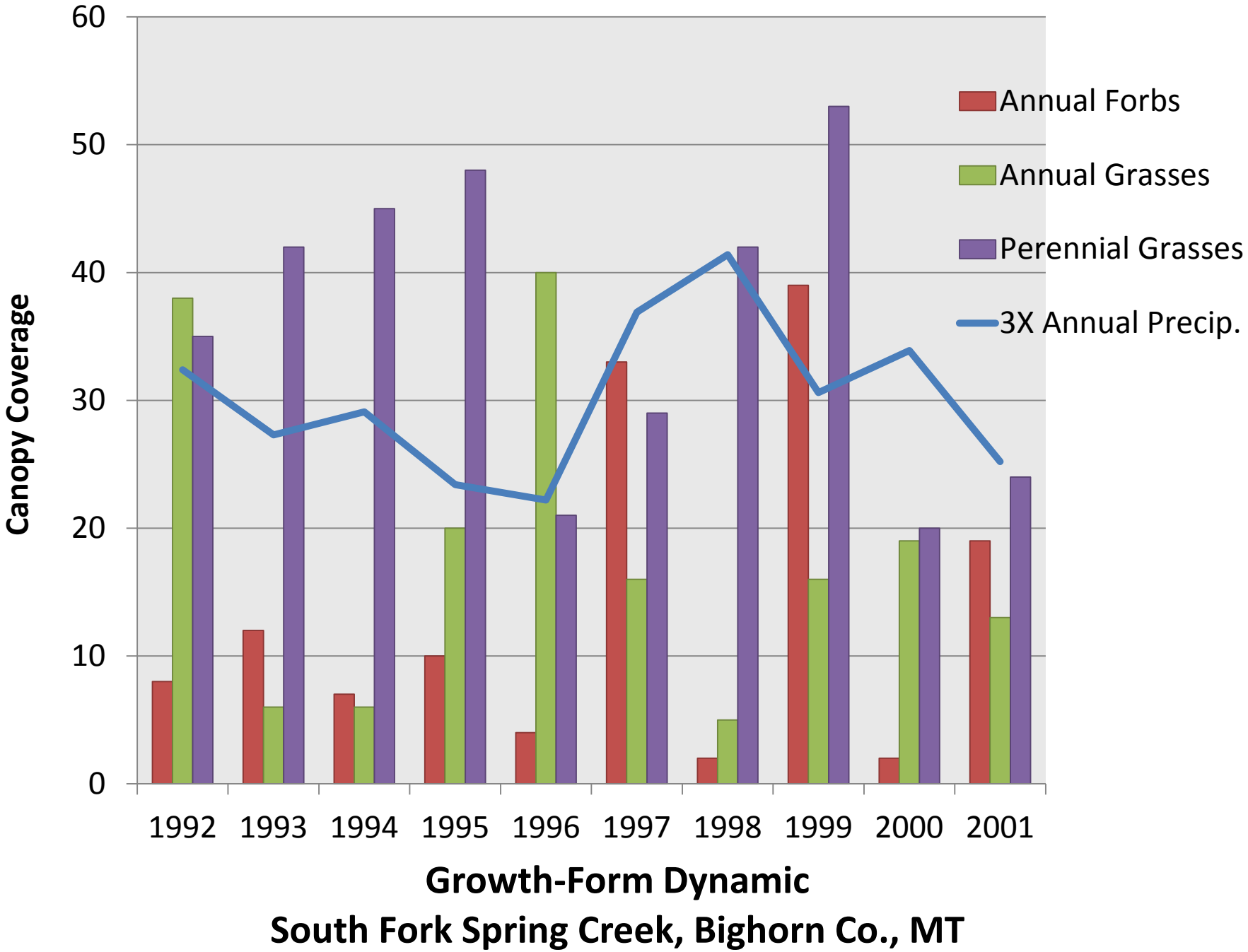
Table 2. Technical vegetation standards, SCCM. Revegetation must meet 90% of the standards with 0.1 Type 1 error.

PERFORMANCE PARAMETER	GRAZING LAND	WILDLIFE HABITAT
SHRUB DENSITY	1,110/HA	5,740/HA
PERENNIAL COVER	50%	46%
PEAK STANDING CROP	775 KG/HA	NA

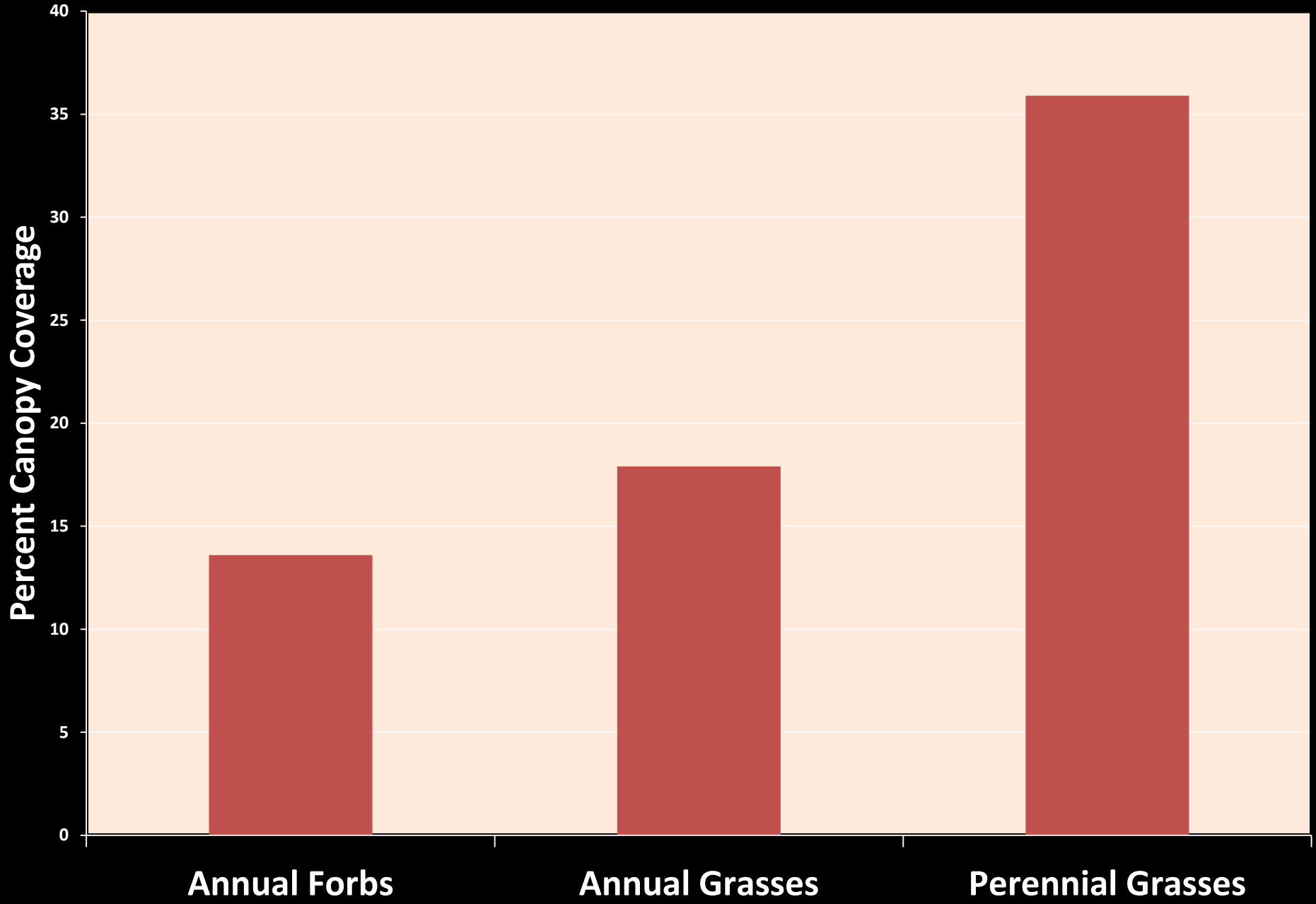
TURNING TO TRENDS

GENERALIZATIONS THAT MAKE THE COMPLICATED APPEAR SIMPLE

USUALLY DIRECTIONAL


Canopy Coverage
60
50
40
30
20
10
0
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
Annual Forbs
Annual Grasses
Perennial Grasses
3X Annual Precip.
Growth-Form Dynamic
South Fork Spring Creek, Bighorn Co., MT

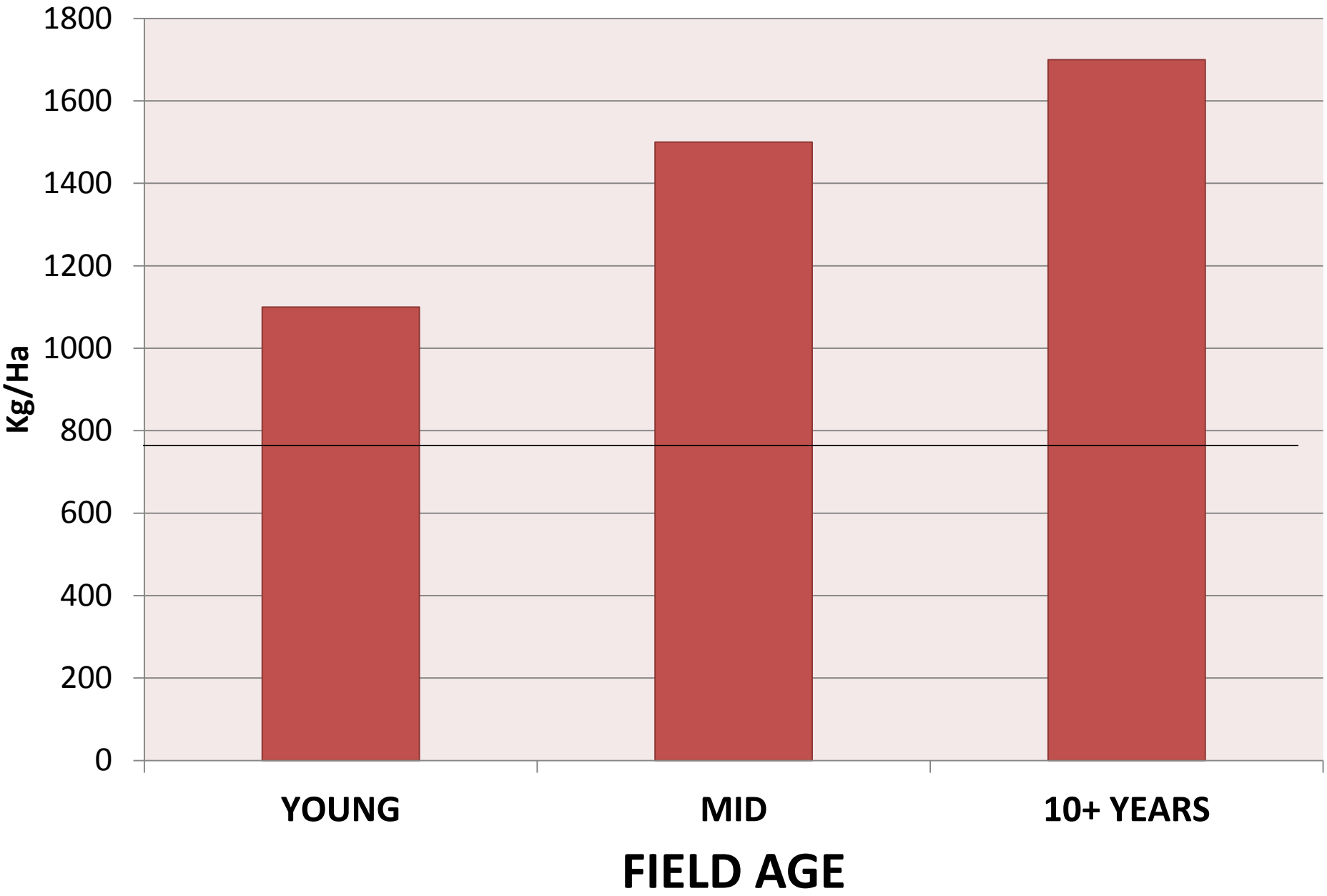
RELATIVE GROWTH-FORM ABUNDANCE



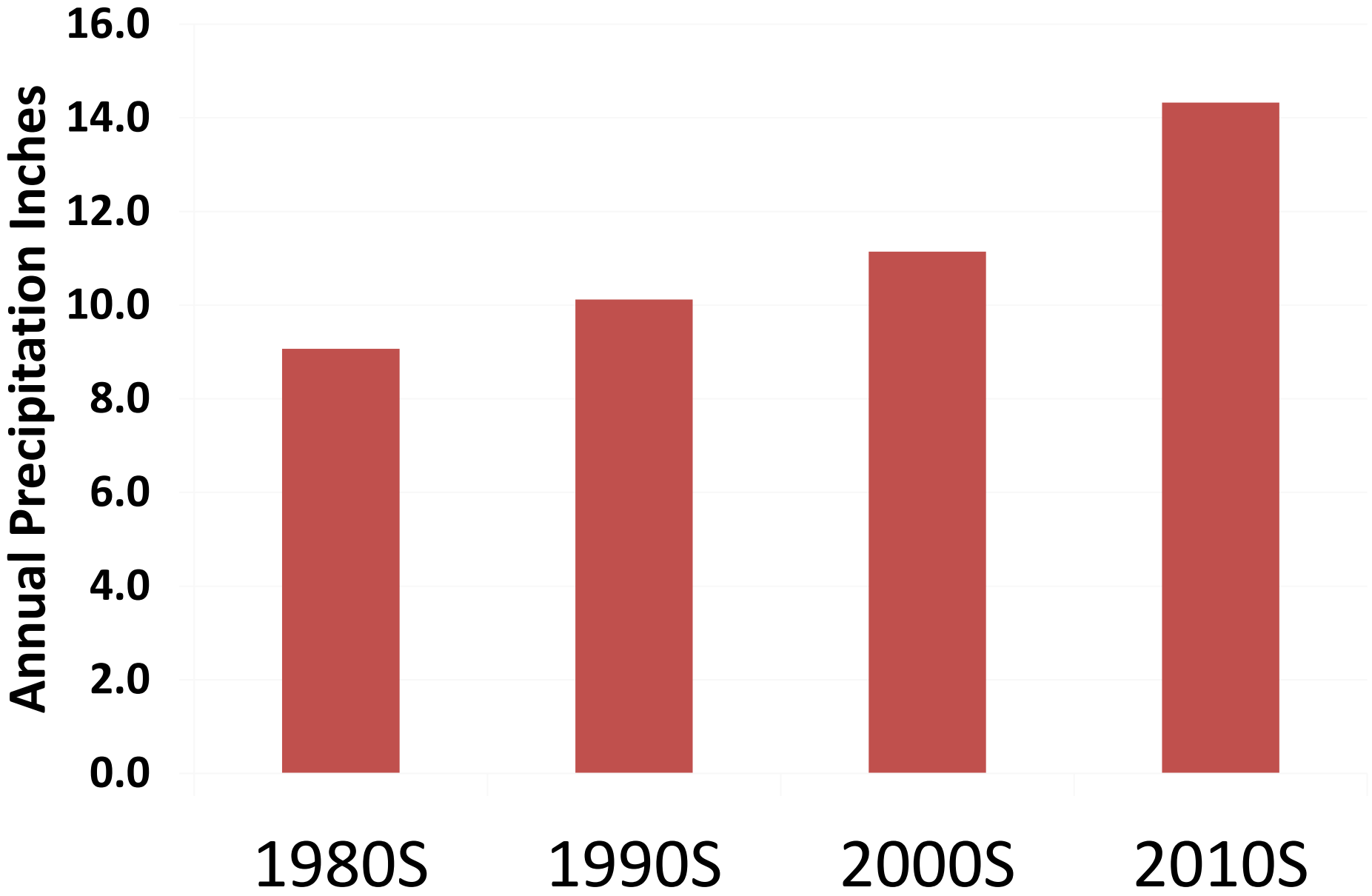
3 TRENDS PERTAIN TO BOND RELEASE

PERENNIAL COVER
PERENNIAL PRODUCTIVITY
SHRUB DENSITY

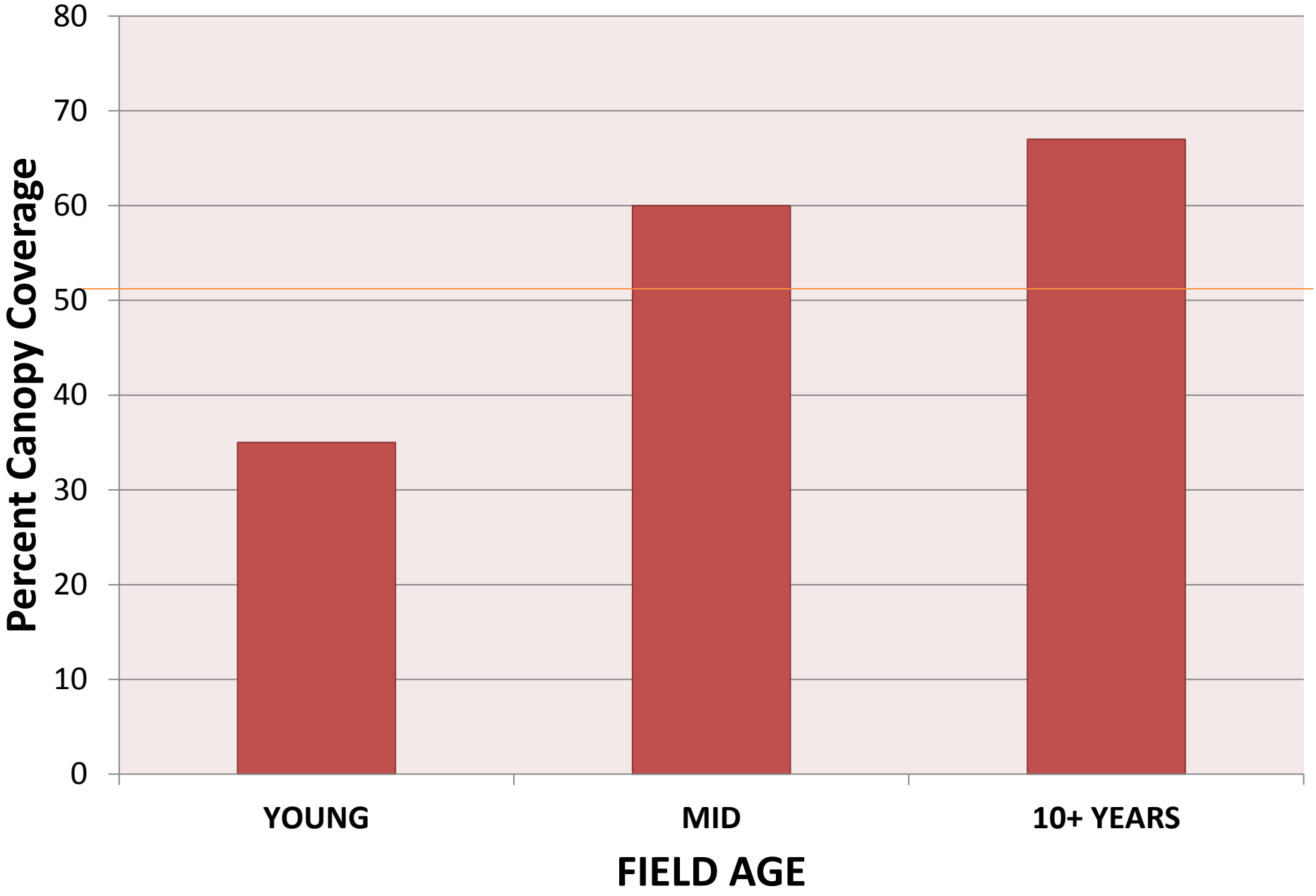
PERENNIAL PSC TREND IN REVEGETATION



PRECIPITATION TRENDS SCM



PERENNIAL C-COVERAGE IN REVEGETATION



TREND: SHRUB DENSITY DECLINES WITH TIME. 82% SURVIVAL AT THE CONCLUSION OF SAMPLING


PARI MI

MORE TRENDS

QUICK LOOK AT 2 PERENNIAL SPP.

WESTERN WHEATGRASS

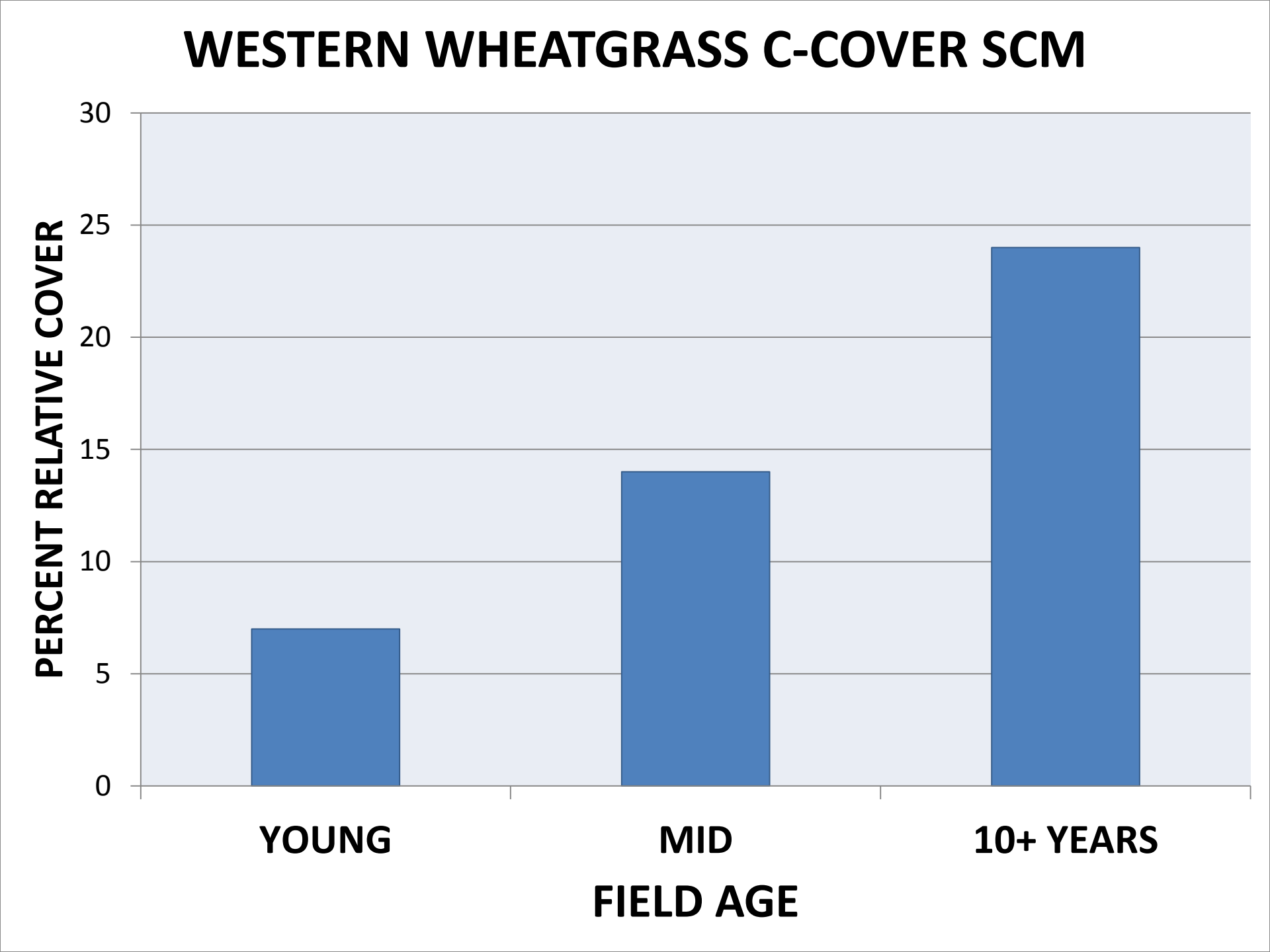
SHEEP FESCUE

WESTERN WHEATGRASS

REVEG ALL-STAR
ORIGINATES LOCALLY
VIGOROUS RHIZ. SPREAD


5
T SOUTH
SEEDED 2003
PHOTO 2007


PAR 5 2015


WESTERN WHEATGRASS C-COVER SCM
PERCENT RELATIVE COVER
30
25
20
15
10
5
0
YOUNG
MID
10+ YEARS
FIELD AGE

In the 2007 monitoring at DCM, **80% of perennial cover** (relative cover) came from a single species:

Western Wheatgrass.

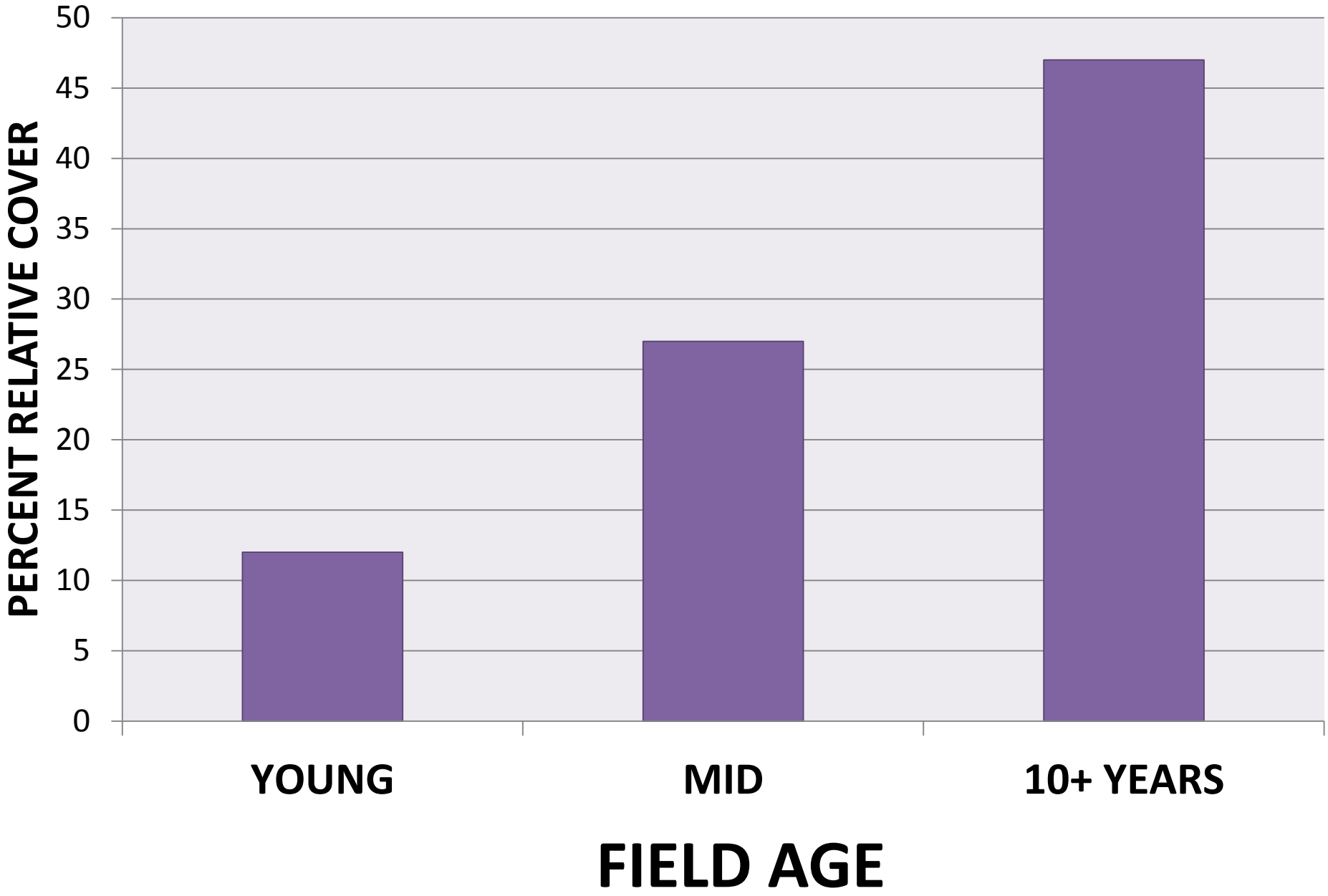
SHEEP FESCUE

REVEG ALL-STAR
INTRODUCED TO U.S.

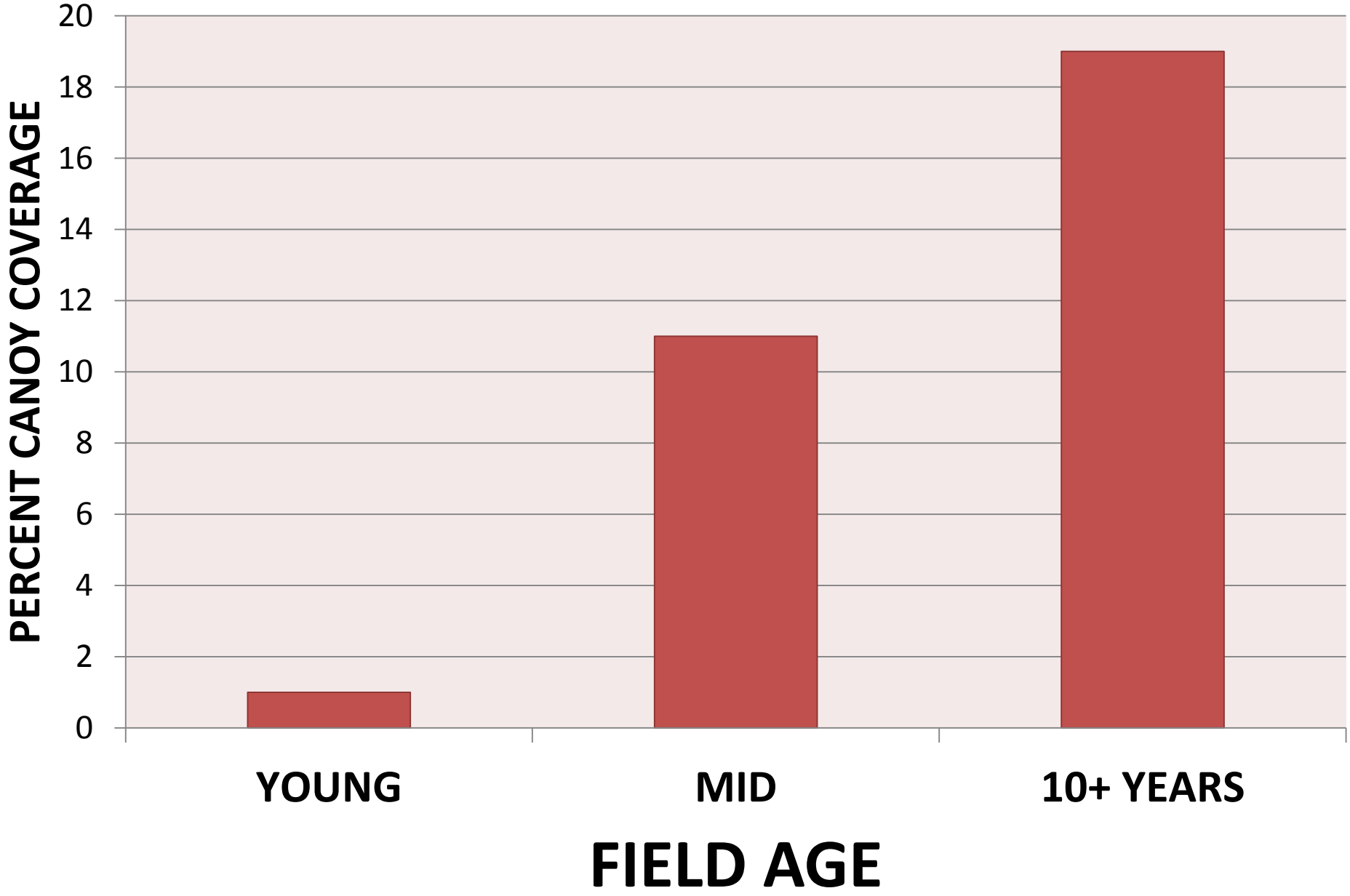
SMALL TUFTED BUNCHGRASS
SPREADS BY COPIOUS
SEED PRODUCTION

SEEDED 1990 PHOTO 2012

SHEEP FESCUE COVER -- SEEDED



SHEEP FESCUE COVER -- UNSEEDED



GROWING SHRUBS FROM SEED

NEXT 3 PHOTOS FROM A SINGLE FIELD, DIFFERENT SEEDINGS


SAGEBRUSH
PAR 2F


GREASEWOOD


FOURWING SALTBUSH

3 MAIN SHRUB SPP.

FOURWING SALTBUSH

DRILL SEED (DE-WINGED)


DRILL THE HEAVY SEED
PAR 5

BLACK GREASEWOOD


EASTERN 4H


PAR 5B

WYOMING BIG

SAGEBRUSH


15 YEARS OLD


BROADCAST THE LIGHT SEED
PAR 4C SEEDED 11/99
PHOTO 2012

2 LOCALLY IMPORTANT SHRUBS

WINTERFAT
USUALLY A SUBSHRUB-
A SHRUB IN REVEG

RUBBER
RABBITBRUSH

RUBBER RABBITBRUSH


B6M

GROWING SHRUBS IN REVEGETATION

START WITH SUBSTRATE

FOR SHRUBS: GOOD **SPOIL**

FOR DIVERSITY BUT LESS ASSURED SHRUBS: **SCORIA**

TOPSOIL IS **PRODUCTIVE BUT WEEDY**

OBSERVATIONS

EXAMPLE OF OB 2, DCM

SPOIL or OVERBURDEN STOCKPILE

UNSEEDED BUT NOW POSSIBLY THE BEST CREATED WILDLIFE HABITAT ON THE MINE


40+ YEARS

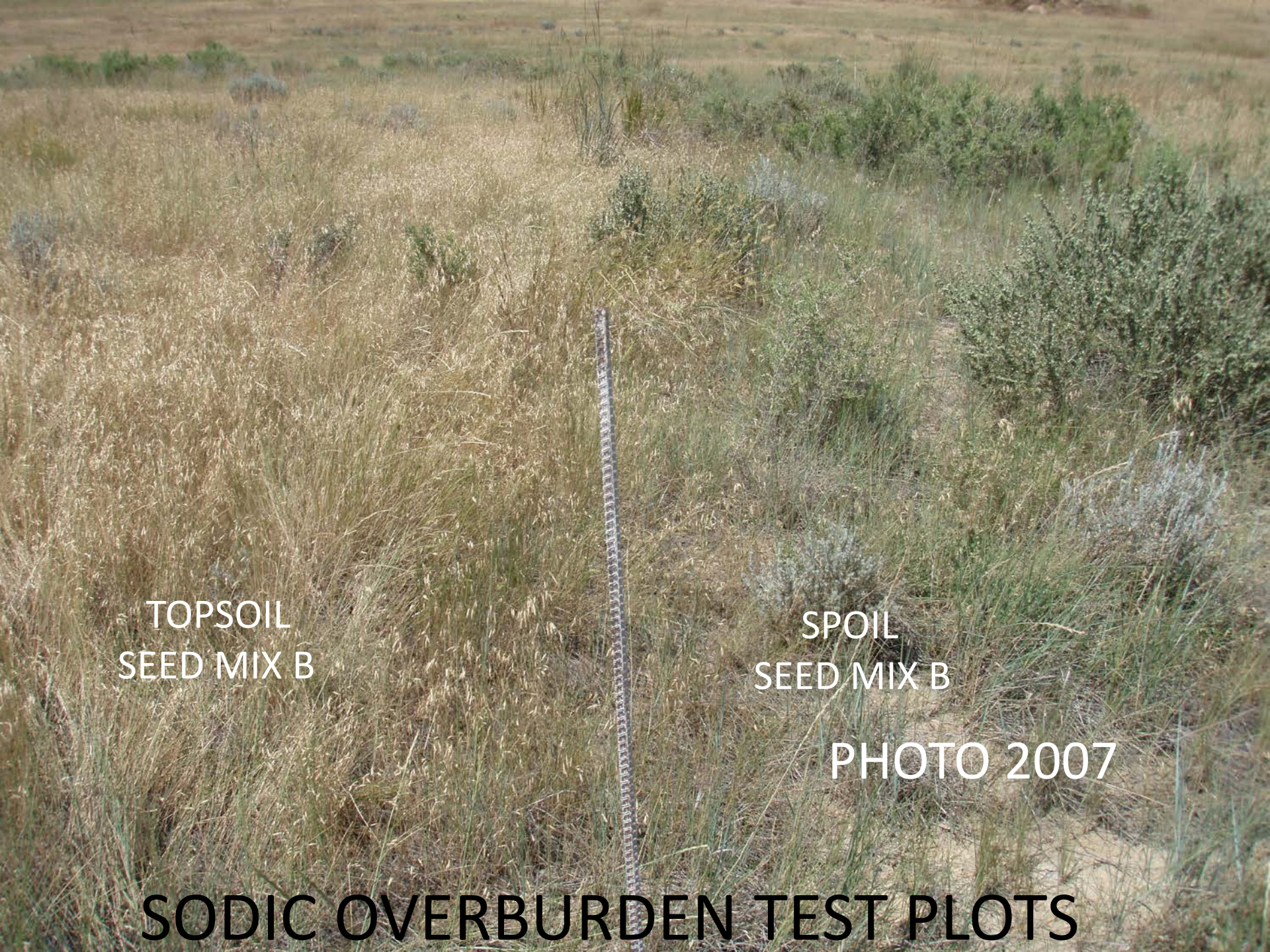
EXAMPLE OF PAR 2C, SCM, SEEDED 11/99

OSM EXCELLENCE IN MINING AWARD


2C
T10
BACK

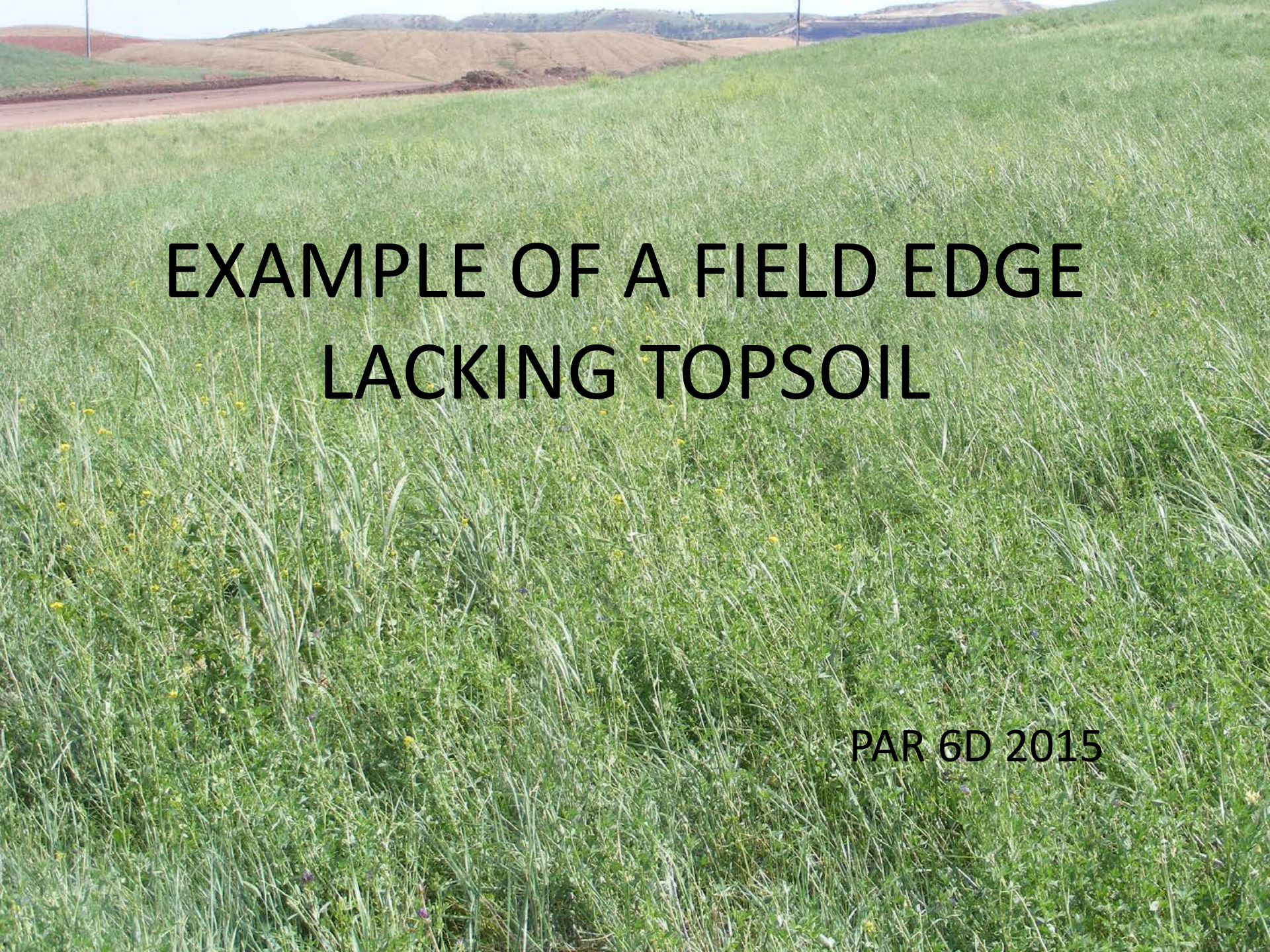
STORY OF PAR 7E

SEEDED MAR-2013
ALL BUT DRAINAGES
SEEDED A SINGLE MIX



SODIC OVERBURDEN TEST PLOTS


TOPSOIL
SPOIL
2009


EXAMPLE OF A FIELD EDGE
LACKING TOPSOIL
PAR 6D 2015

ALL SPOIL IS NOT EQUAL

(SAME FOR SCORIA)


D8m2
T7

SCORIA *CAN BE* GOOD SHRUB HABITAT

SCORIA CAN BE
THE PREMIER DIVERSITY
SUBSTRATE


1.0
2.0
3.0
4.0
5.0

SEEDING SAGEBRUSH
ON TOPSOIL

SEGREGATE THE SAGEBRUSH SEED SPATIALLY FROM THE HEAVY SEED


MANY SUCCESSES
B7 m2


PAR 4D

SUCCESSES NOTWITHSTANDING

CAN’T GET SAGEBRUSH ALL THE TIME OR EVEN MOST OF THE TIME

REDUCE COMPETITION
SHRUB MOSAICS

AREAS WITHIN A LARGER FIELD SEEDED WITH SAGEBRUSH AND OTHERS MINIMALLY COMPETITIVE
e.g., all light seed


SEEDED 10/97
PHOTO 2012


ICTIO

ORDER SEED IN TWO
SETS OF BAGS
LIGHT AND HEAVY SEED

DRILL THE HEAVY
BROADCAST THE LIGHT

NEXT, BLOCK SOME SEED DRILLS

SO THAT DRILL-ROW SPACING

IS 18” OR 24” BUT LIGHT SEED

IS BROADCAST EVERYWHERE


PAR 6D


SUNFLOWER
9010 STUBBLE DRILL
SUNFLOWER

OR SEED THE ENTIRE FIELD

WITH LIGHT SEED, THEN

DRILL SEED PART OF IT

RANDOMLY OR SYSTEMATICALLY


GRASSE ER


GRASSLANDER


PAR 5H 2013


PAR 5H 2014


2014

OR SEED SOME OTHER INNOVATIVE WAY

THERE ARE OTHER LESSONS FROM COAL COUNTRY