



**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

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

ALLUVIAL

SPECIAL SUBSTRATES

SHRUB MOSAICS

**COAL DISTURBANCE MT**

$$63 \text{ mi}^2 = 163 \text{ km}^2$$

**0.2% OF CROPLAND**

$$28,000 \text{ mi}^2 = 73,000 \text{ km}^2$$























# SMCRA 1977

REVEG. DIVERSE, EFFECTIVE, PERMANENT

NATIVE SPP. EXCEPT PASTURES

≥ PREMINE COVER AND PROD.

CONTROL EROSION





COAL RECLAMATION  
BECOMES THE CRUCIBLE  
FOR WESTERN  
REVEGETATION

**MT COAL AND URANIUM  
MINE RECLAMATION  
WEAKENED 2003**

**STILL REQUIRES “PERIODIC” MONITORING  
and  
CORRECTIVE MEASURES AS NECESSARY  
TO COMPLY WITH THE PERMIT  
OR AS THE DATA INDICATE**



MINIMUM 10 YEAR TO  
EVALUATE PHASE 3  
BOND RELEASE

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

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AGE (YRS.)	4' Suitable Fill	8' Suitable Fill
	----INDIV/HA (% SURVIVAL)---	
4	8,370 (100)	17,700 (100)

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4	8,370	(100)	17,700	(100)
7	7,490	(89)	10,350	(58)
10	2,580	(29)	2,670	(15)
11	2,460	(29)	2,520	(19)

























1000 DAYS





7/21

10

WS





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

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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)

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\* 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.

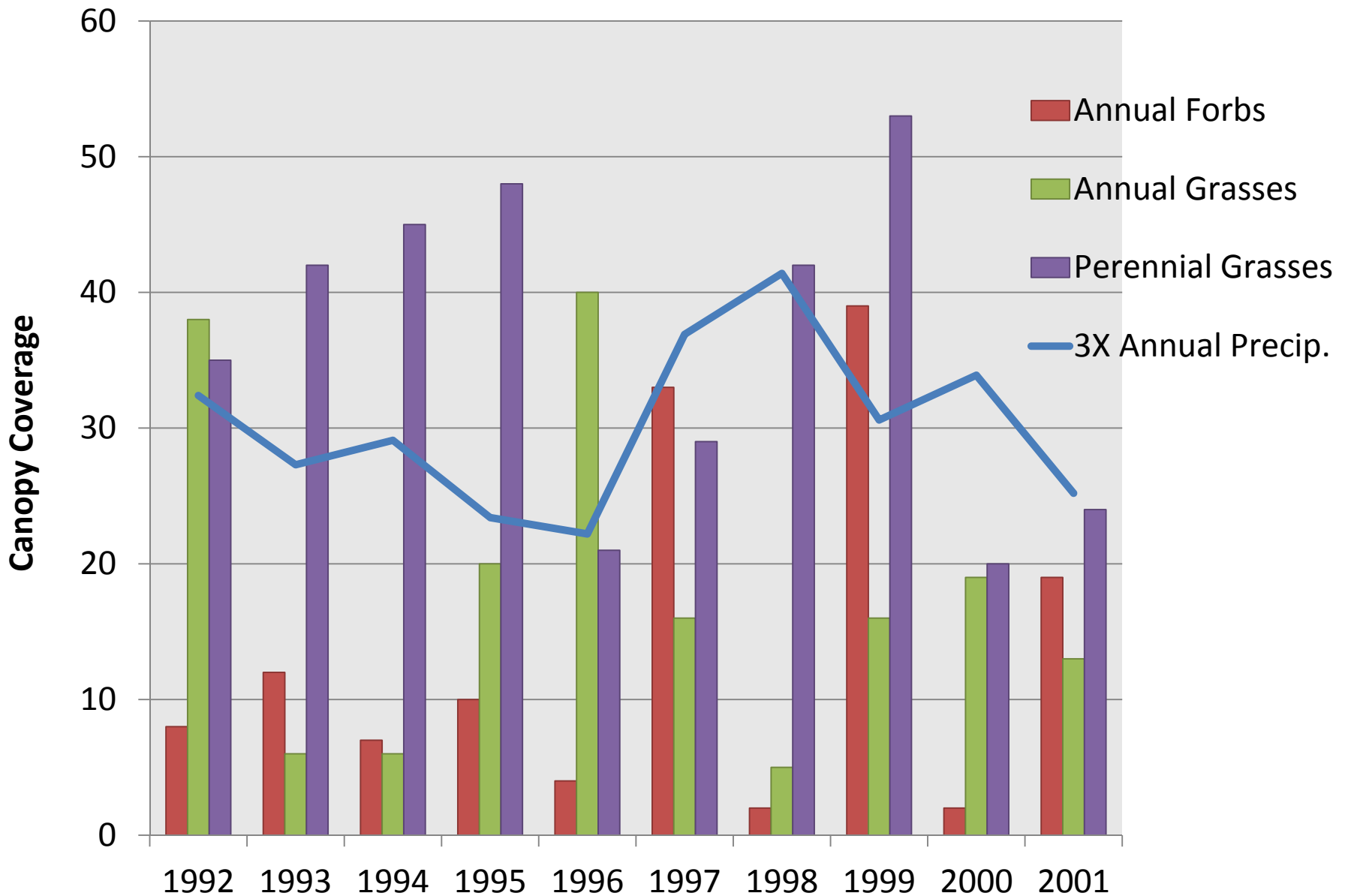
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PERFORMANCE PARAMETER	GRAZING LAND	WILDLIFE HABITAT
SHRUB DENSITY	1,110/HA	5,740/HA
PERENNIAL COVER	50%	46%
PEAK STANDING CROP	775 KG/HA	NA

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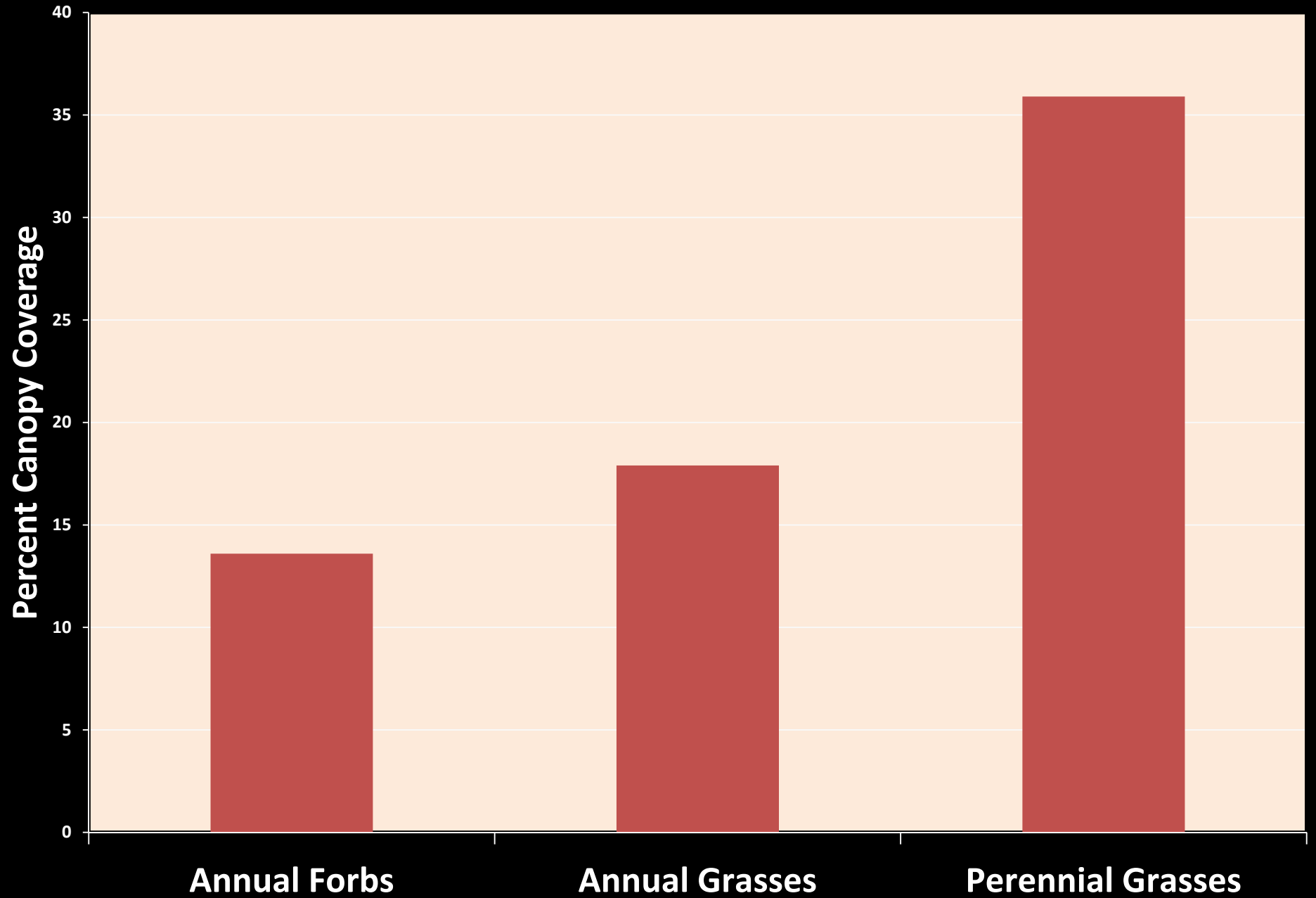
**TURNING TO TRENDS**

**GENERALIZATIONS THAT  
MAKE THE COMPLICATED  
APPEAR SIMPLE**



**Growth-Form Dynamic**  
**South Fork Spring Creek, Bighorn Co., MT**

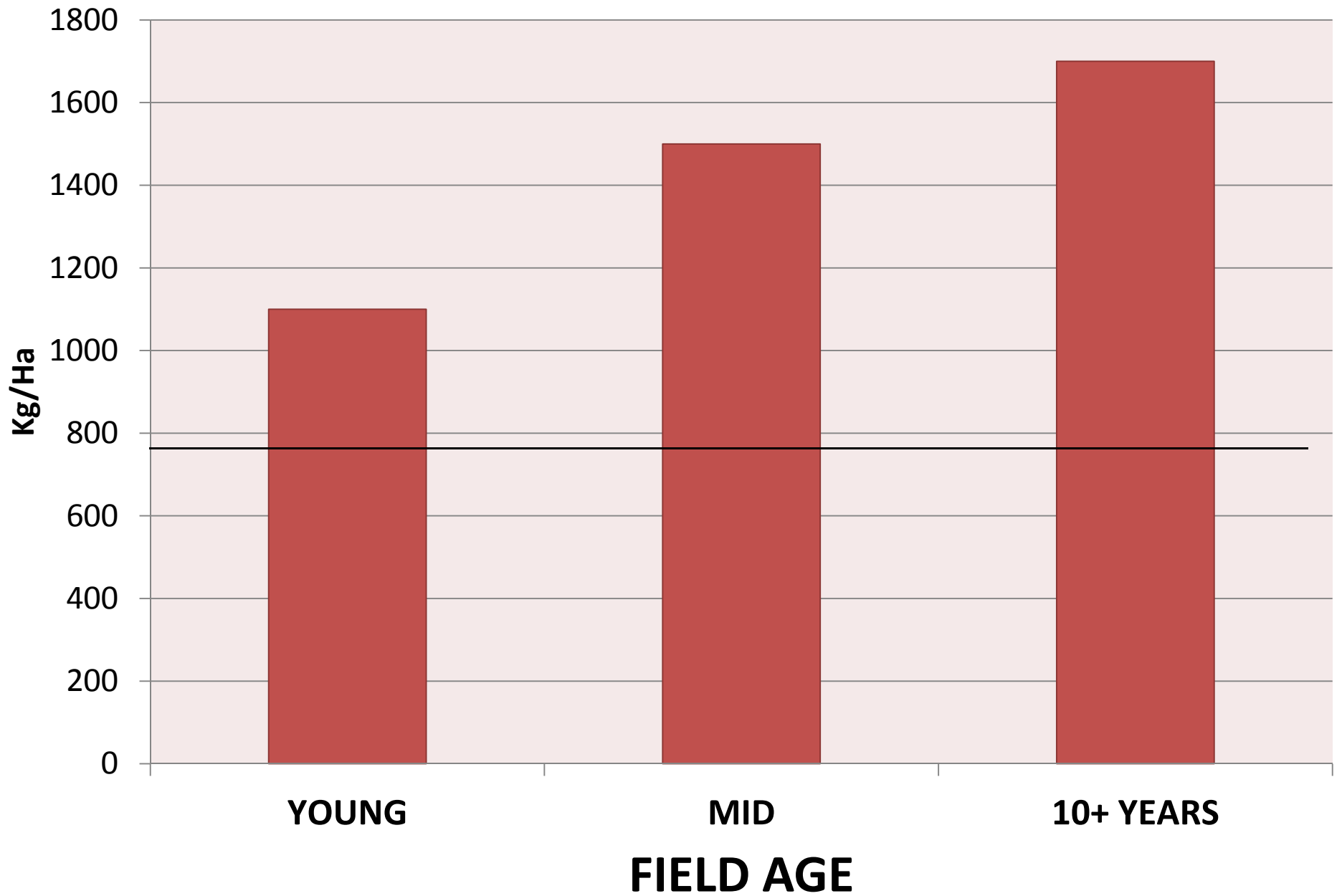
# RELATIVE GROWTH-FORM ABUNDANCE



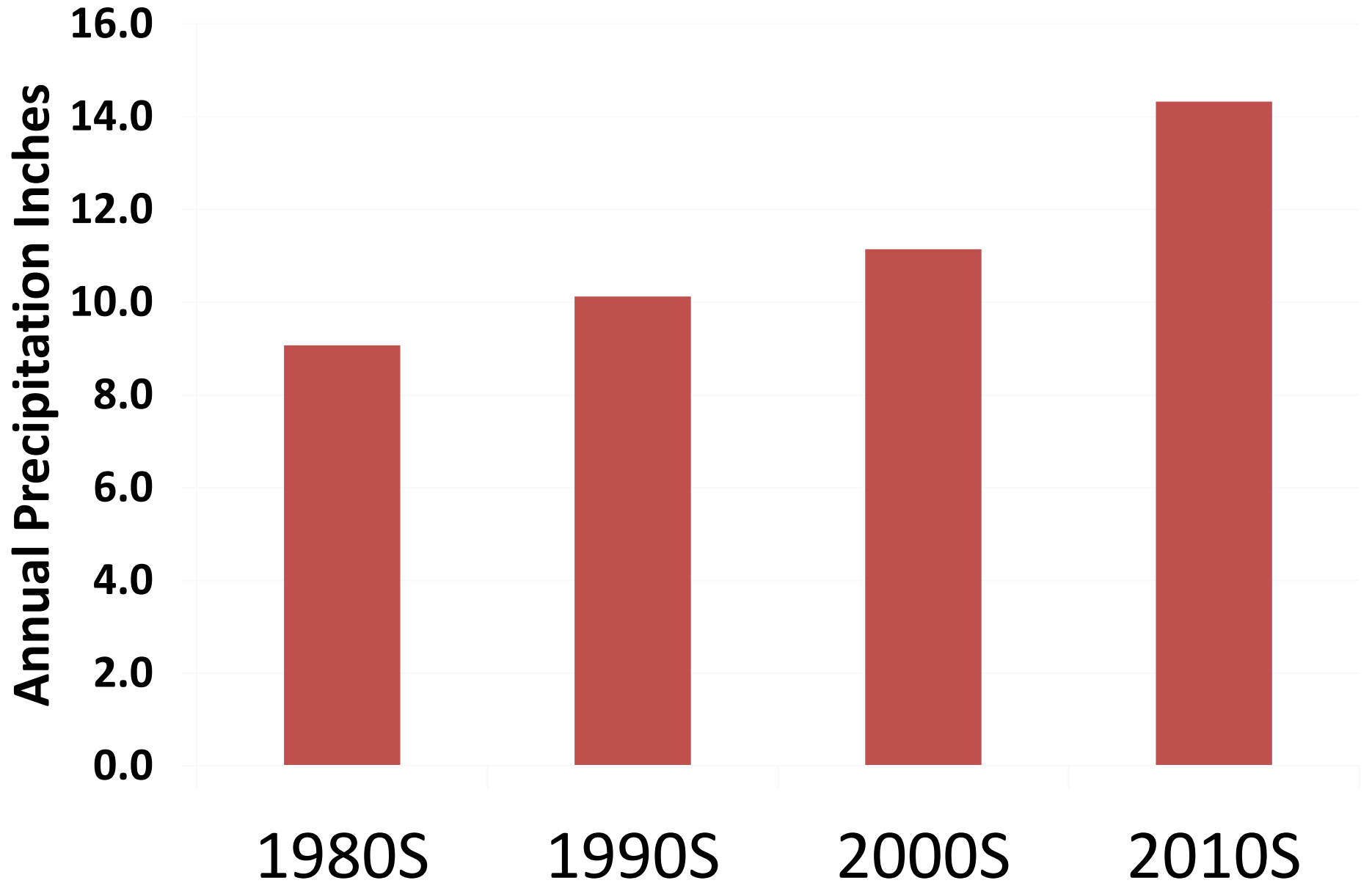
**FOCUS ON 3 TRENDS FOR  
BOND RELEASE**

**PERENNIAL COVER  
PERENNIAL PRODUCTIVITY  
SHRUB DENSITY**

# PERENNIAL PSC TRENDS IN REVEGETATION



# PRECIPITATION TRENDS SCM





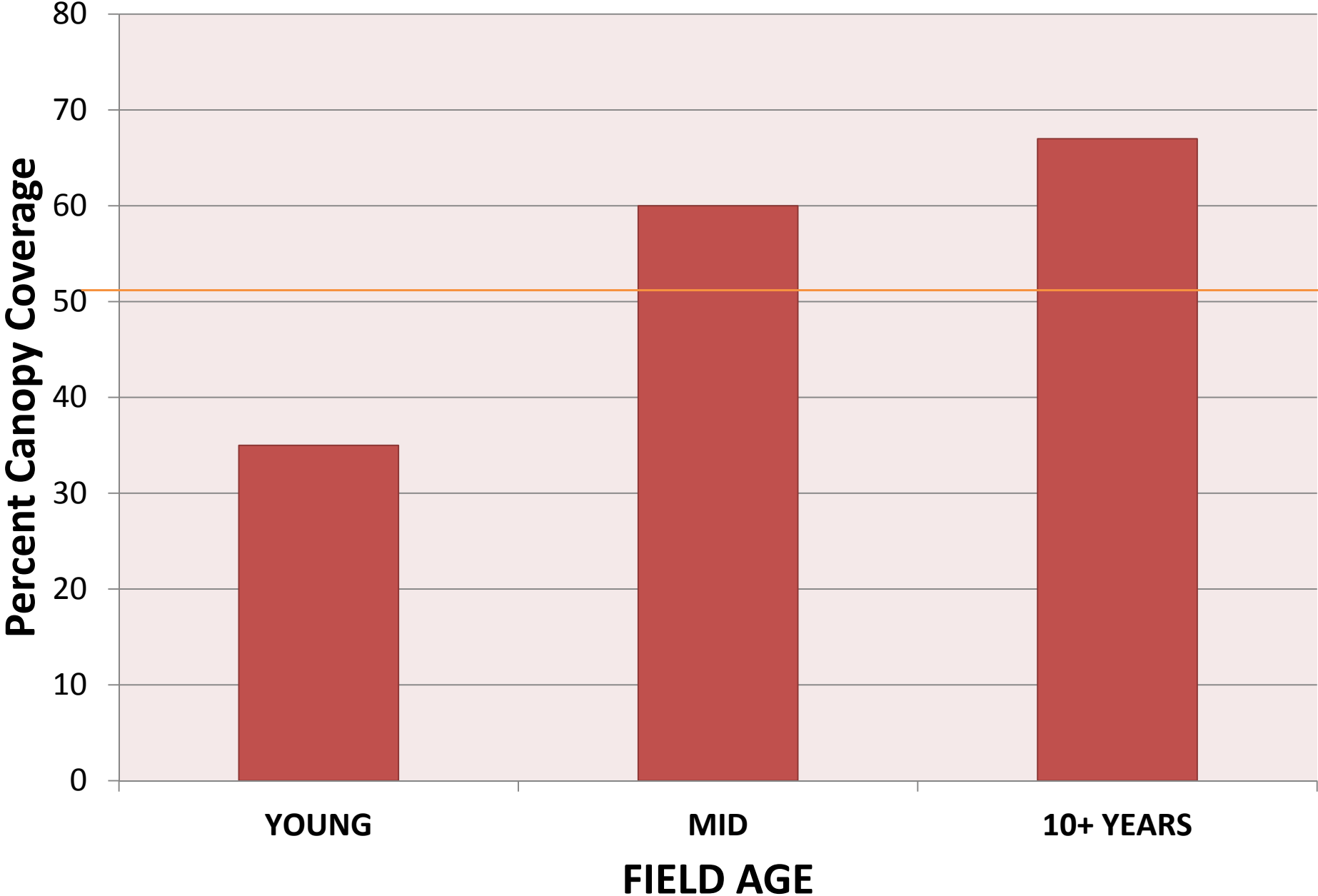




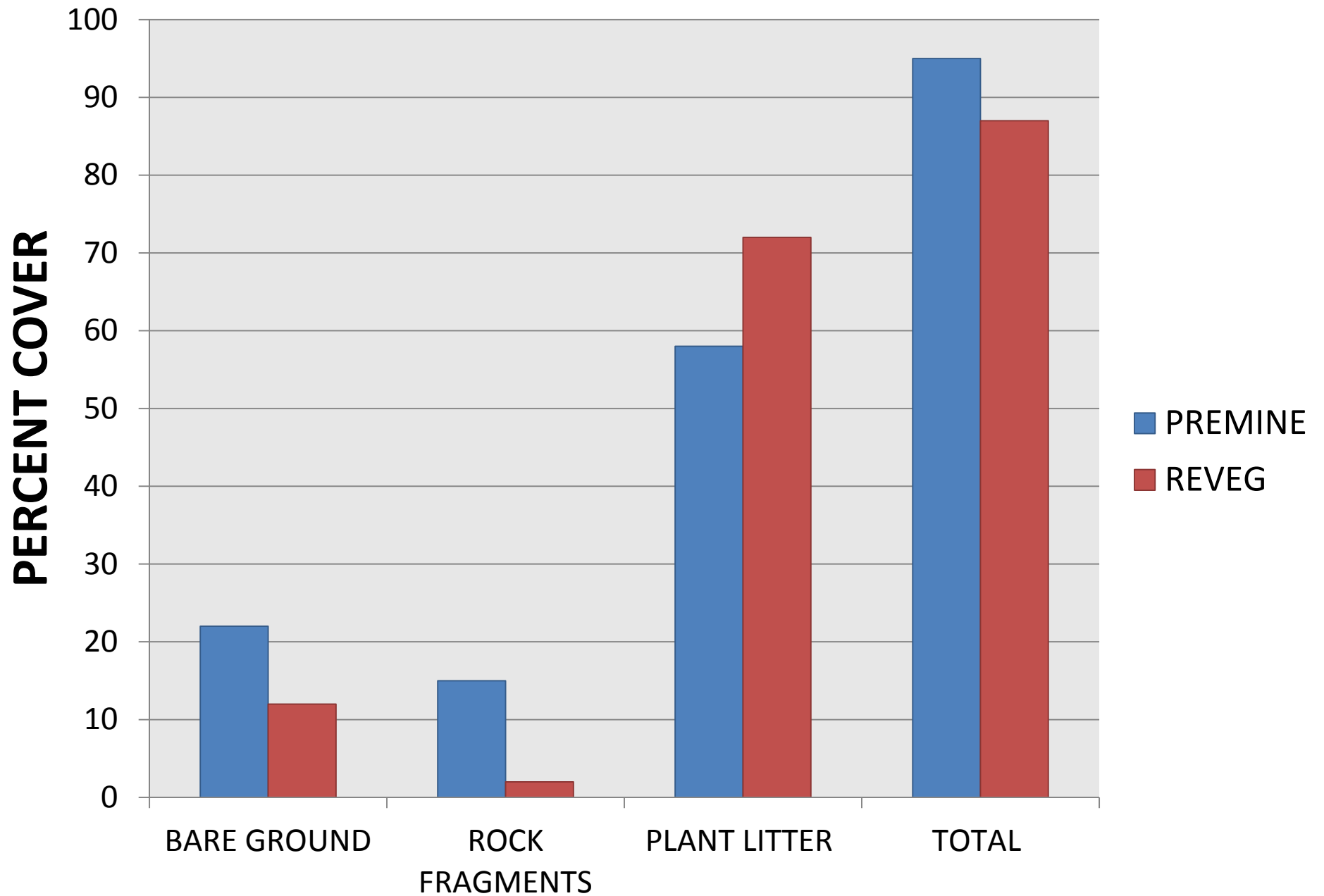




# PERENNIAL C-COVERAGE IN REVEGETATION



# GROUND COVER PREMINE AND REVEG





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



PAR 5





PAR 1B ST3







QUICK LOOK AT 3 SPP.

CHEATGRASS

WESTERN WHEATGRASS

SHEEP FESCUE





2007  
PRECIP. 13.2"





2008  
PRECIP. 10.7"





2012  
PRECIP. 10.5"





2015 PRECIP. 11.5"





TOPSOIL STOCKPILE SCM





TOPSOIL STOCKPILE DCM





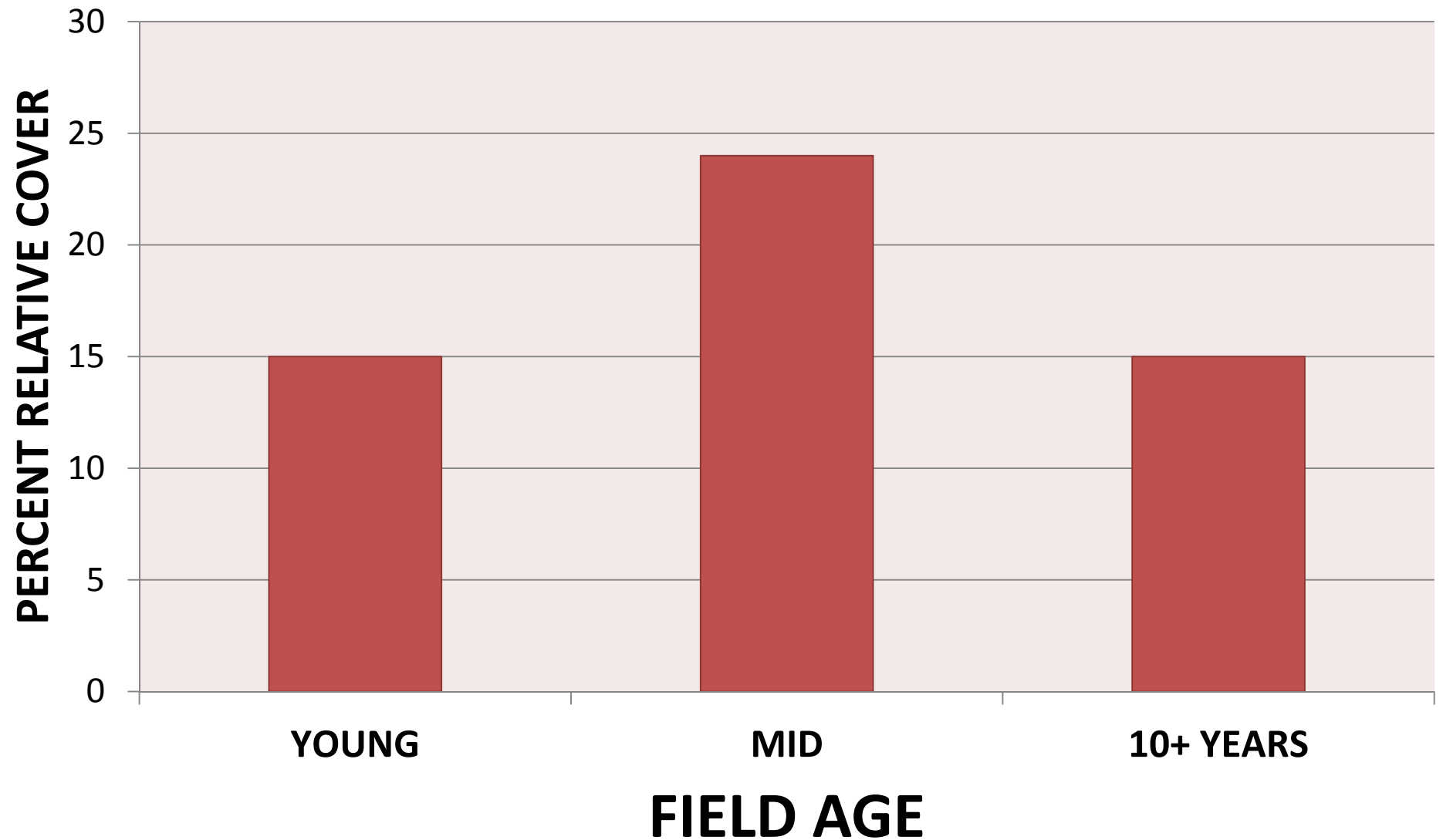
NATIVE  
By  
PAR 5 ATSM





DCM C HILLS

# CHEATGRASS COVER IN REVEGETATION SCCM





# WESTERN WHEATGRASS

REVEG ALL-STAR

ORIGINATES LOCALLY

VIGOROUS RHIZ. SPREAD







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

**Western Wheatgrass.**





**PAR 3 SEEDED 1997**

**PAR 1G SEEDED 10/06  
AND 4/11**





5  
T SOUTH

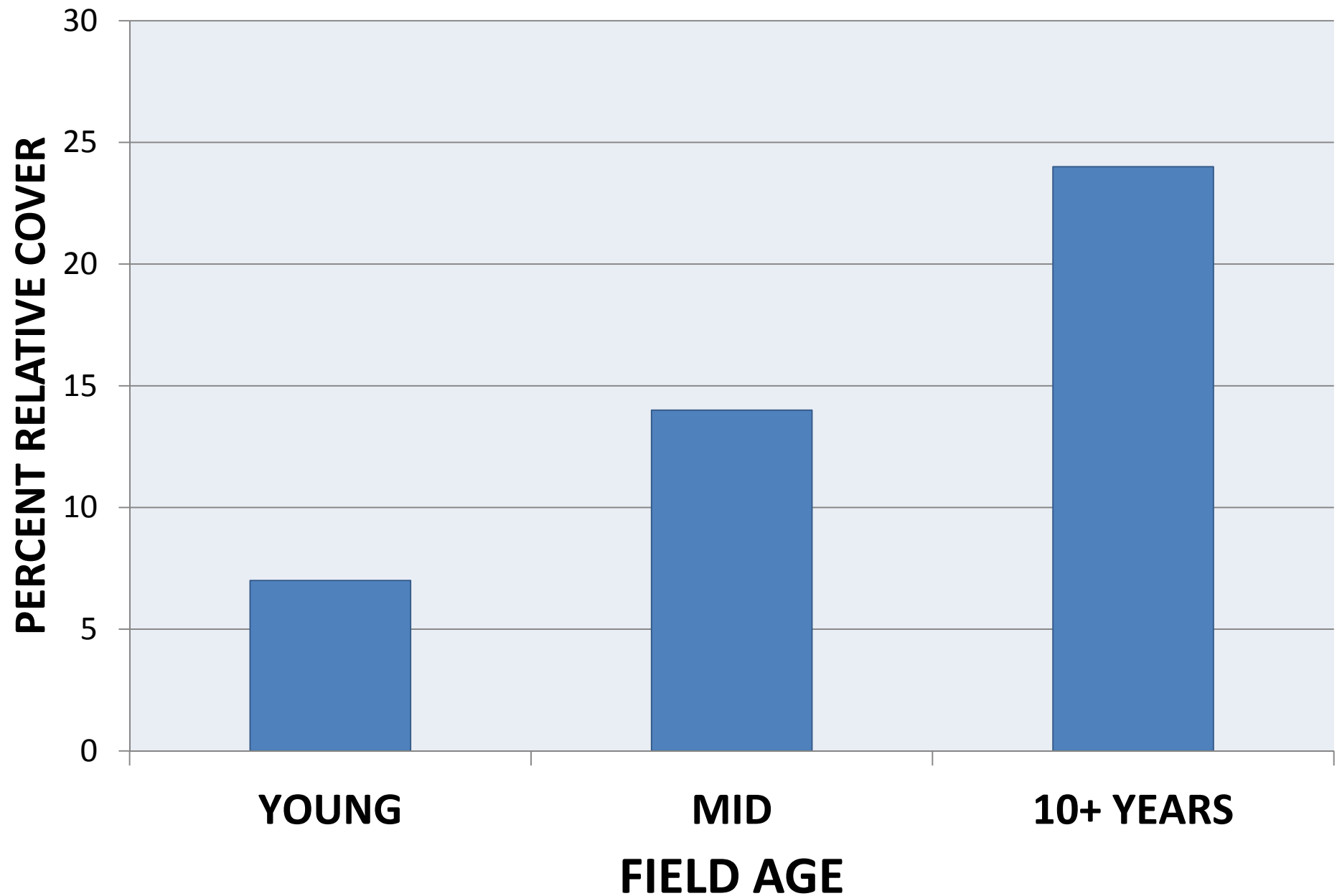
2007





PAR 5 2015

# WESTERN WHEATGRASS C-COVER SCCM





# **SHEEP FESCUE**

**REVEG ALL-STAR  
INTRODUCED TO U.S.**

**SMALL TUFTED BUNCHGRASS  
SPREADS BY COPIOUS  
SEED PRODUCTION**

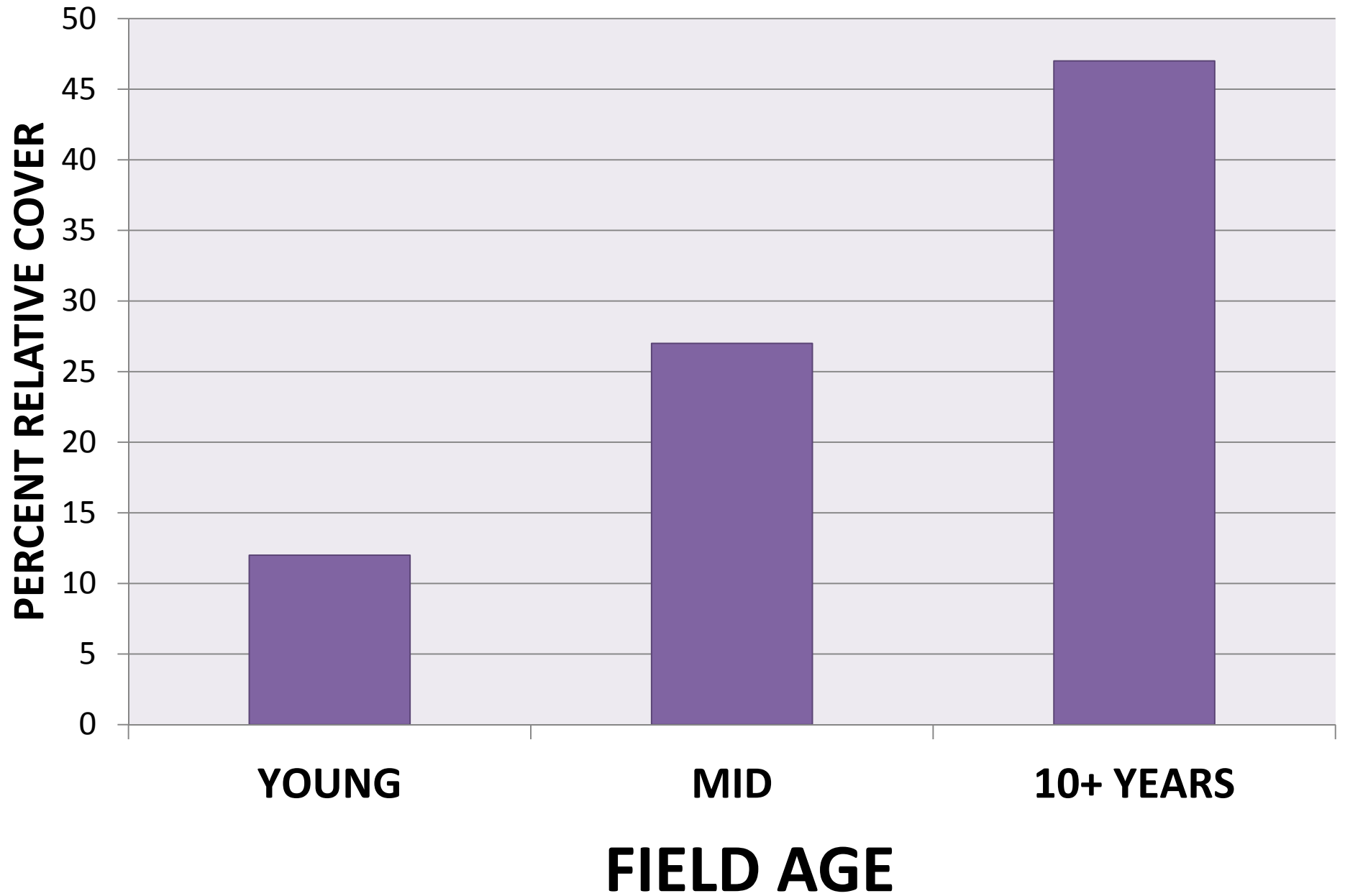


SEEDED 1990 PHOTO 2012



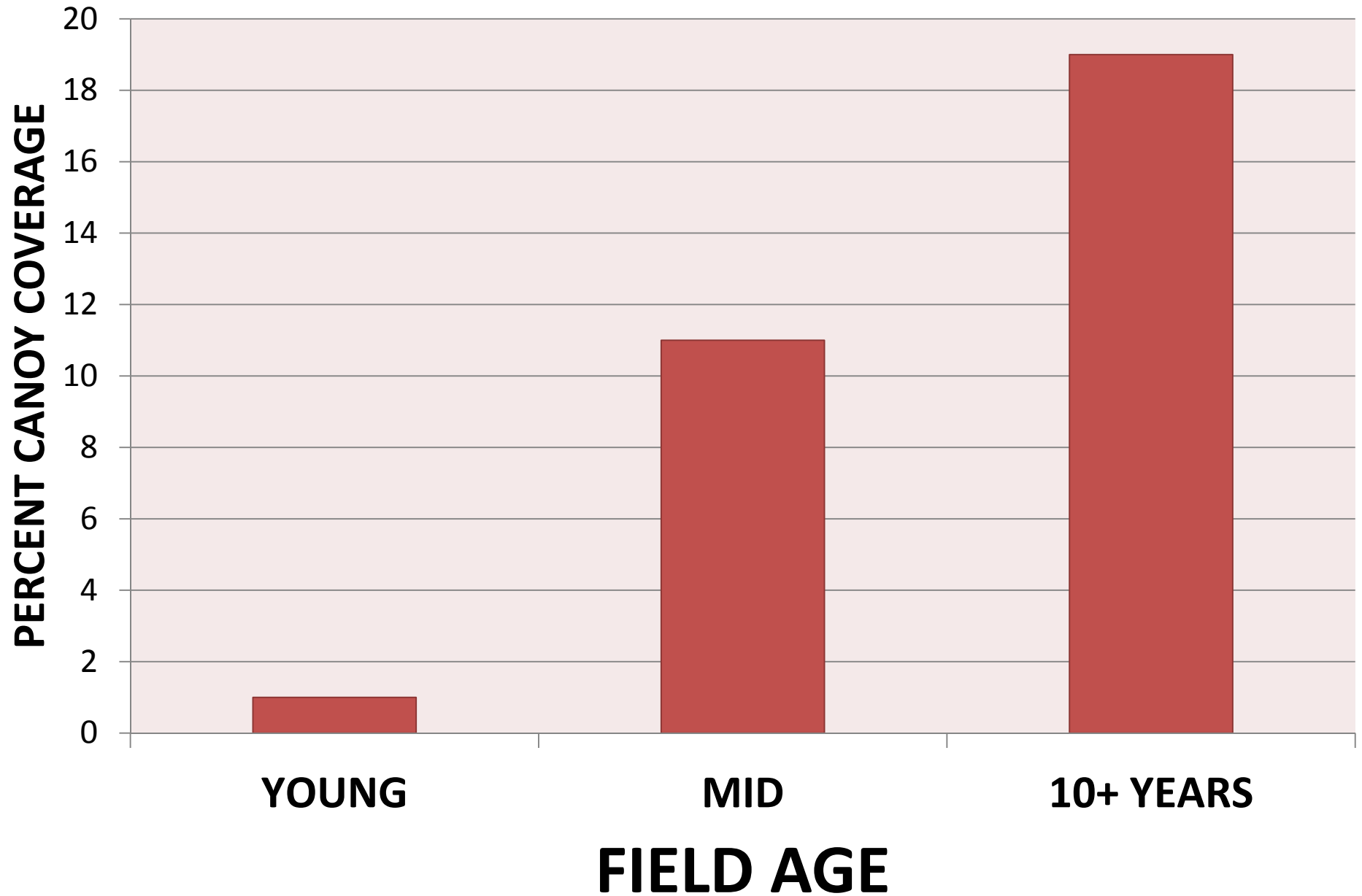


# SHEEP FESCUE COVER -- SEEDED





# SHEEP FESCUE COVER -- UNSEEDED









NO TIME FOR HOW TO  
GROW SHRUBS FROM SEED

NEXT 3 PHOTOS FROM  
A SINGLE FIELD,  
DIFFERENT SEEDINGS





PAR 2F











DEALING WITH  
ANNUAL-BIENNIAL  
WEED PATCHES

IN REVEGETATION

TYPICAL PROGRESSION  
IN A POOR SEEDING

KOCHIA → TUMBLEMUSTARD →  
CHEATGRASS





Kochia roots 2 weeks









































**MANAGE TO PREVENT KOCHIA**

**DON'T LEAVE COVERSOIL UNSEEDDED  
ANY LONGER THAN NECESSARY**

**ERADICATE KOCHIA RESERVES  
ON THE MINE**













**KOCHIA**

**MOW IT**

**RELEASE OVERTOPPED**

**PERENNIALS**

**KOCHIA CAN STILL**

**PRODUCE SEED**





KILL KOCHIA WITH  
GLYPHOSATE AND A  
WEED WIPE







# CAN TRY INTERSEEDING IF SOME KIND OF SEEDBED



PAR 5B CHEATGRASS SEEDED 4-11



# FULLY INTERSEEDED 5 YEARS AFTER ORIGINAL SEEDING



PAR 1G







**ANNUAL-BIENNIAL  
FORBS AND CHEATGRASS**

**PRE-EMERGENT CHEMICAL  
CONTROL FOLLOWED BY  
LITTER REDUCTION  
THEN SEEDING**



B-HILLS





C-HILLS









SKIP ONE  
GROWING SEASON

SEED IN SPRING  
JUST WESTERN AND  
CHENOPOD SHRUBS



SEED TOO SOON –  
CHEMICALS INHIBIT THE  
SEEDING

SEED TOO LATE –  
WEEDS RETURN WITH  
THE PERENNIALS

THERE ARE OTHER  
LESSONS









N2U-F97  
T2+



