

**FITNESS, NOT DIVERSITY,
GUIDES THE RECOVERY
PROCESS**

Combines Three Favorite Topics:

Fitness

Recovery

Patterns

Fitness Is as Fitness Does

Tautology: what's fit works
What works is fit.

EVOLUTION: ADAPTATION

The acquisition or modification of traits that “fit” the organism more perfectly to its environment.

**A PROCESS KNOWN BY
INFERENCE.**

**Can't be sure fitness today
will confer advantage in a
future environment.**

**BUT IN THE FOLLOWING
CASES, IT SURE DID.**

Recovery Process

Colonization or a Desired Shift
in Vegetational or Structural
Composition, as from
Introduced Weeds to Desired
Perennials

THE RECOVERY PROCESS

READ ROBERT McINTOSH'S 1980 article: The relationship between succession and the recovery process in ecosystems. pp. 11-62 IN: J. Cains, ed. The recovery process in damaged ecosystems. Ann Arbor Sci. Pub.

PATTERNS

SPATIAL PATTERNS

For example, Revegetation
Naturally Starts in Draws or
Lower Slopes and Drainages and
Spreads to Sideslopes

TEMPORAL PATTERNS

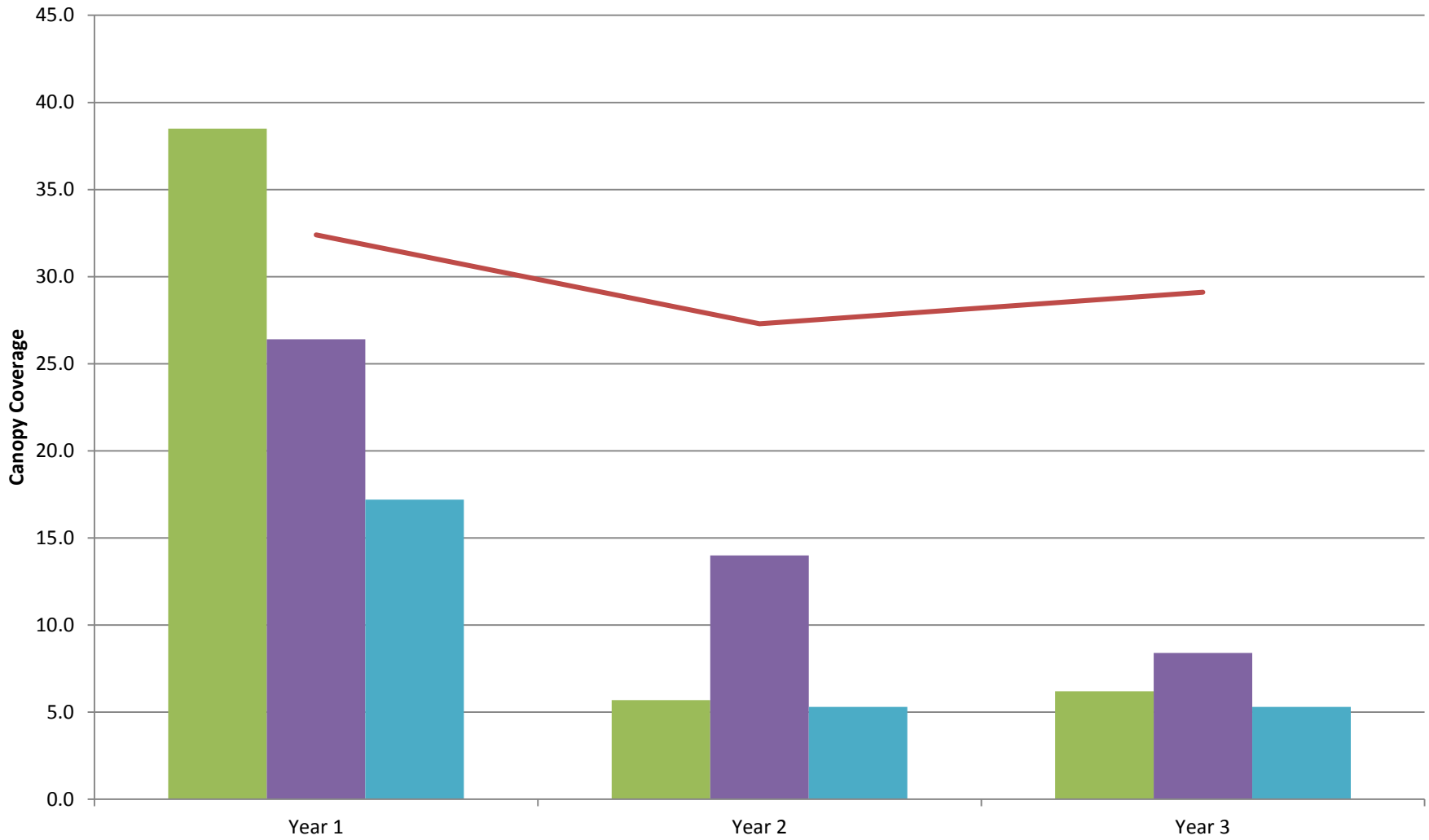
WEEDS → PERENNIALS

or PERENNIALS → NOXIOUS

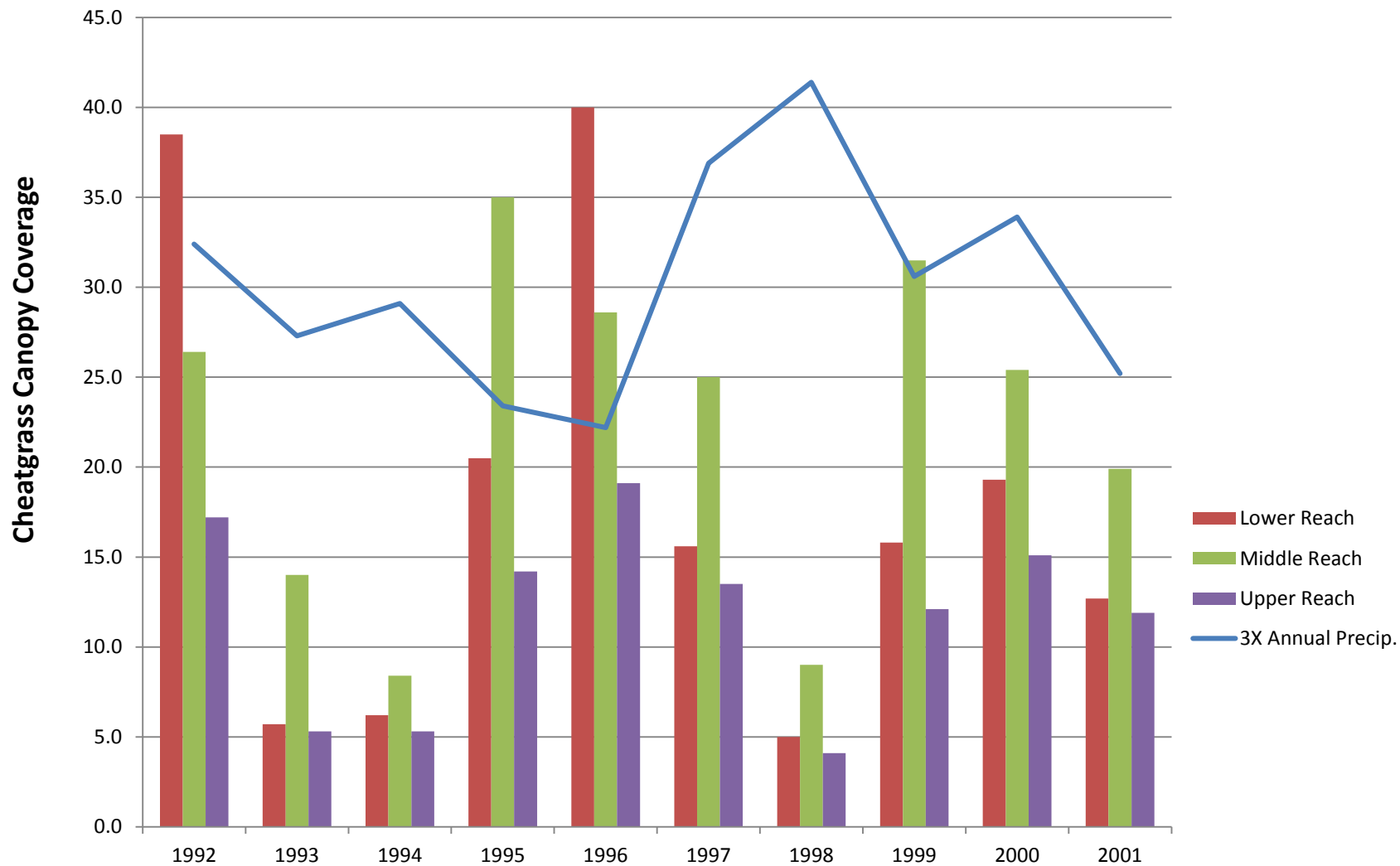
WEEDS

FIRST CASE HISTORY
COAL REVEGETATION
CHEATGRASS →
WESTERN WHEATGRASS

Controlling Cheatgrass



CHEATGRASS CONTROL EFFECTIVENESS



**Figure 1. Cheatgrass Dynamic
South Fork Spring Creek, Bighorn Co., MT**

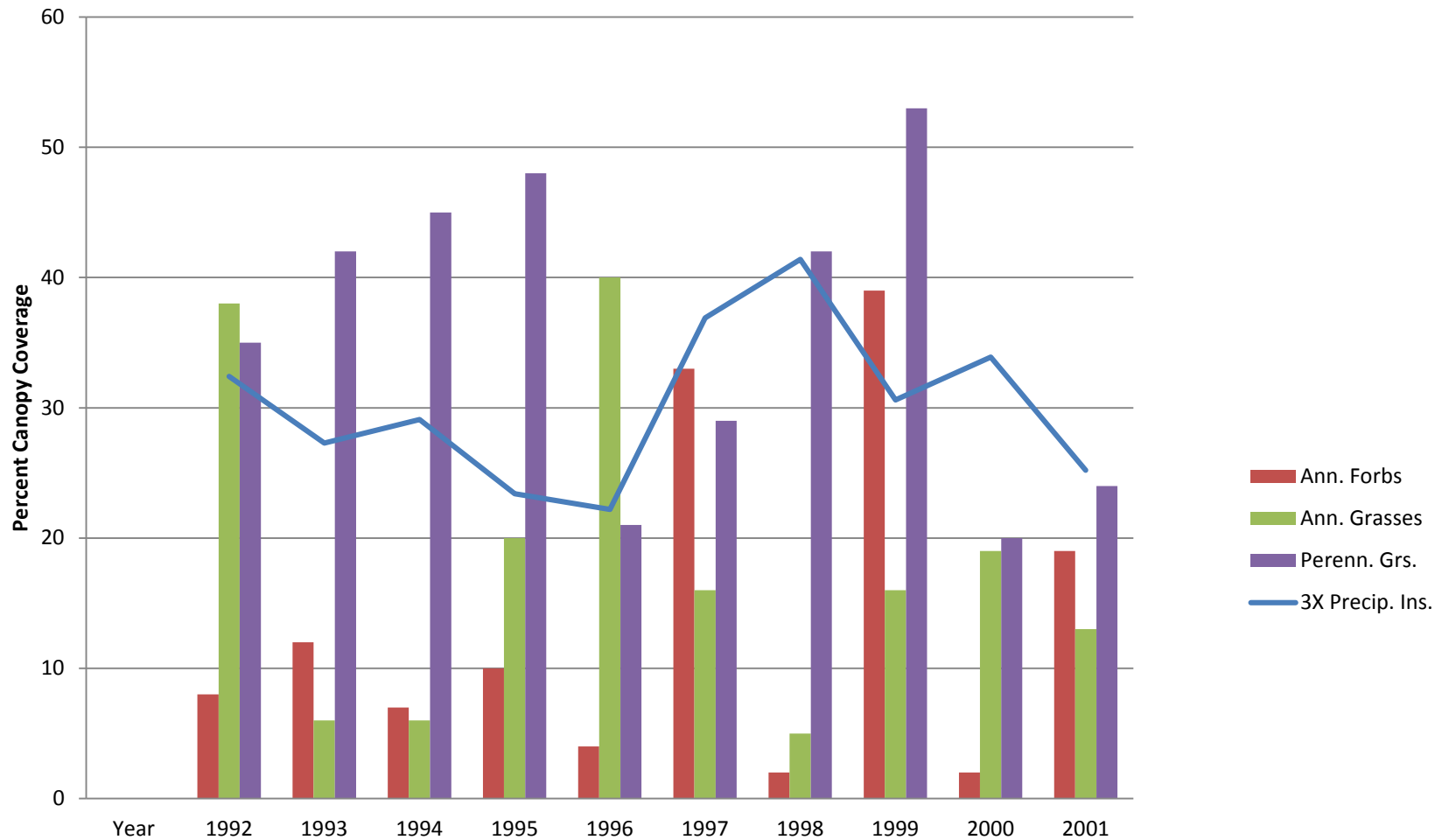


Figure 2. Important Growth-Forms















2H T21
p.5
12



















A person wearing a red hard hat and an orange safety vest with reflective yellow stripes is standing in a field of tall, dry grass. The person is holding a white rectangular sign with their right hand. The background shows a vast, open landscape with rolling hills under a clear sky.

Death Valley
South East '99





HOW?

**WHICH TWO WORDS
ARE RELATED?**

APPLE	ENGINEER
CHALET	HUBRIS

N17m -
FO1





A hand holding a piece of cardboard with handwritten text 'E8u' and 'T-2' in a field of dry grass. The background shows a vast, flat landscape with dry, yellowish-brown grass and some sparse green patches. In the distance, there are several small, rounded hills or mounds of earth, and a few utility poles are visible against a clear sky.

E8u
T-2

700 acres





ROSANA WESTERN WHEATGRASS

ORIGINATED FORSYTH MT 1959
RELEASED 1972 AS *ROSANA*
AGGRESSIVELY RHIZOMATOUS
PRODUCED TIGHTEST SOD













Seeded 1987

E5p
T-3









SECOND CASE STUDY

CLARK FORK RIVER FLOODPLAIN

So. OF DEER

LODGE, MT

METAL-CONTAMINATED

DITCH WATER









LAST CASE STUDY

**SMELTER-IMPACTED UPLANDS
SOUTHEAST OF FAIRMONT
MONTANA**



SO₂ + METALS FUMIGATION
MAINLY WINTER INVERSIONS
FIRST HALF 20th CENTURY
DEFOLIATION
DEATH OR SELECTION
DIFFERENTIAL EROSION
RECOVERY



Stack built in 1901.

Extended 300 feet around
1917.

Recovery: About 100 years.

ONCE AGAIN a rhizomatous
grass led the recovery
process.

Agrostis stolonifera L.
Redtop or bentgrass



A. alba L.
Dum. 96

590 Gramineae
Probably *Agrostis alba* L.
var. *stolonata* (L.) J.E. Smith

MARCH 2011







WET AREAS
RECOVER FASTEST









ASPEN

Dormant during winter
inversions.

Conifers take brunt of
fumigation.





ASPEN: THREE ADAPTATIONS

TEMPORALLY AVOIDS
FUMIGATION (DECIDUOUS)

SPROUTS FROM ROOTSTOCKS

BURNS POORLY



























**WHAT THREAD
CONNECTS THE
THREE SPECIES?**

EXAMPLE: ASSISTED RECOVERY



















C17
Real 19.04 Bntg

A FEW SPECIES

WESTERN WHEATGRASS

QUAKING ASPEN

REDTOP

**ACCOUNTED FOR MOST
VEGETATIONAL RECOVERY IN
THREE AREAS IN MONTANA**

SOME ORIGINATED LOCALLY
SOME NOT

A HOST OF INDIGENOUS
SPECIES PLAYED NO ROLE
WHATEVER

IT'S NOT HOW MANY SPECIES

IT'S HOW FIT THE DRIVERS
OF THE RECOVERY
PROCESS