Mixed Conifer Forest Classification

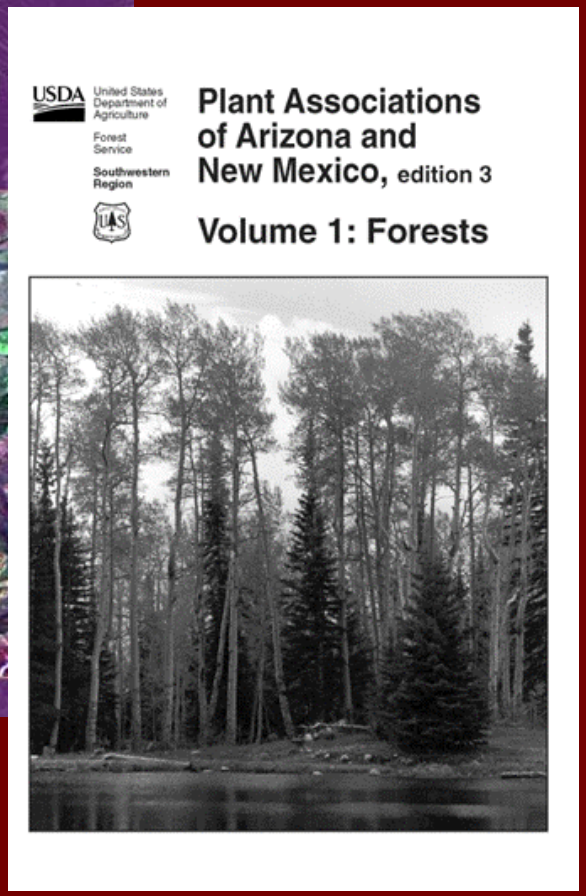
USFS SW Region Desired Conditions and Forest Plans

October 2016
Sacramento Mountains Desired Conditions Workshop

OBJECTIVES

- Describe dry and wet mixed conifer forests, and how they differ (classification)
- Describe Forest Plan desired conditions for mixed conifer forests based on forest classification criteria
- Describe links between desired conditions and differing ecological restoration treatments by forest type

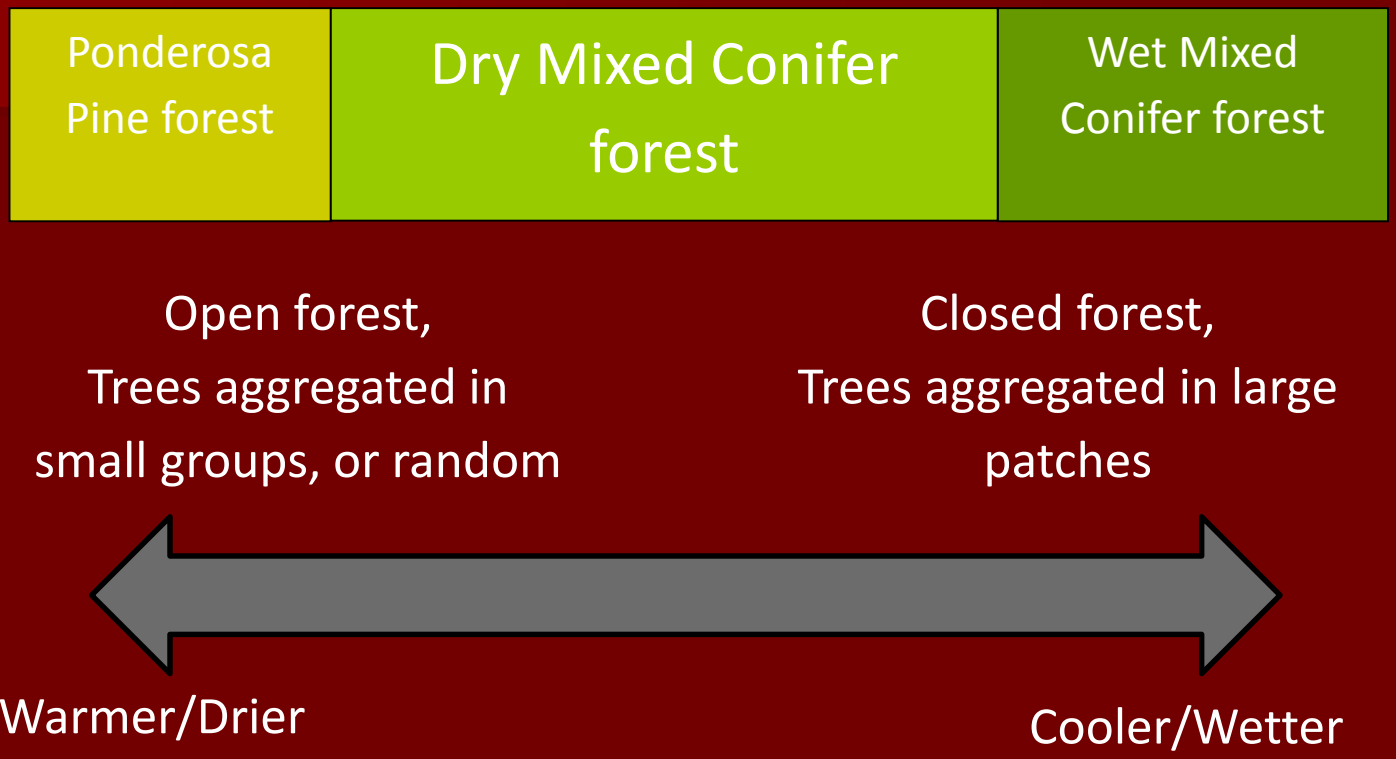
Classification Guides Used for R3 Forest Plans



Terrestrial Ecosystem Inventory data describes the bio-physical site conditions used for classification (climate, soils).

Plant Associations describe plant species assemblages and successional patterns (with and without disturbances).

Montane Forest Characteristics



Mixed Conifer Forests

- grouped by species & characteristic functions

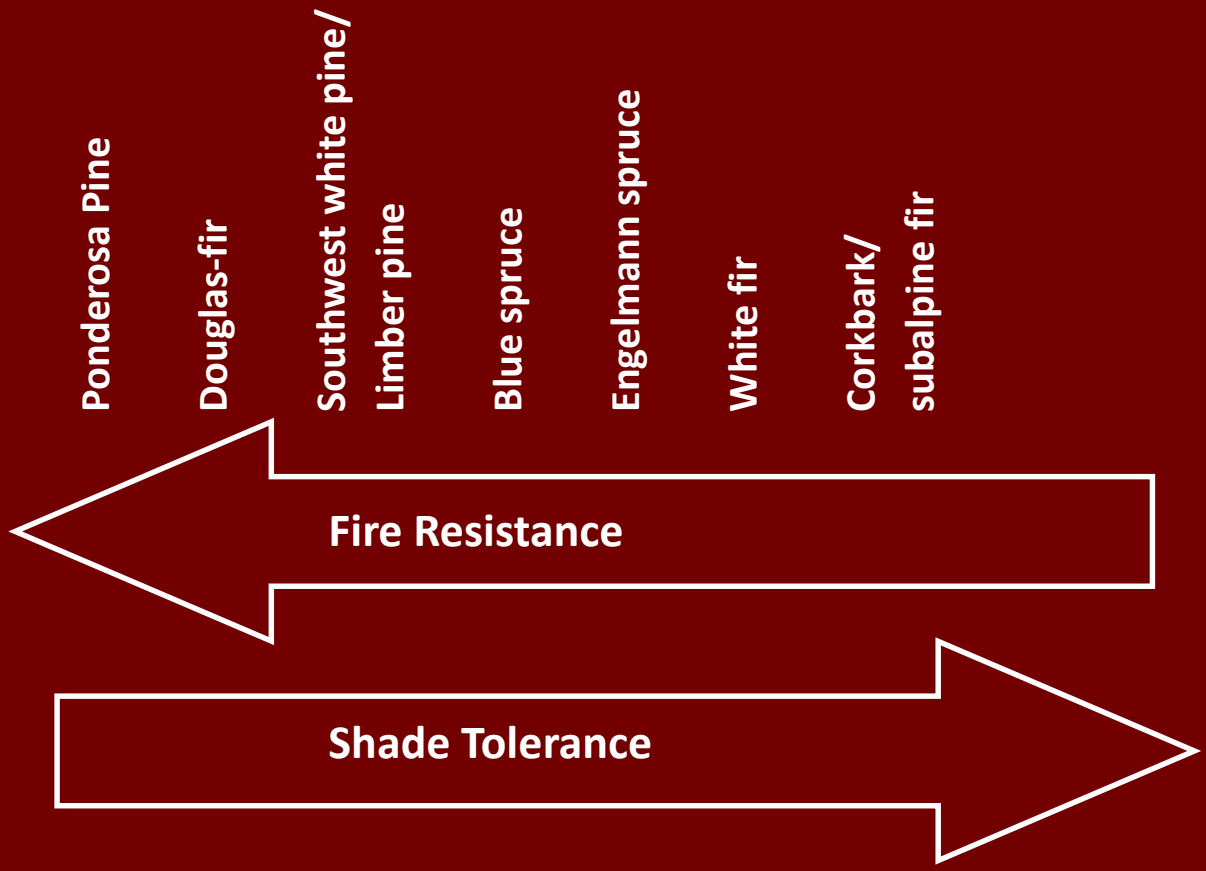
- Forest disturbances and succession
  - Dry mixed conifer forests are maintained as a fire dis-climax type under natural disturbances. Species composition and structure are maintained within a relatively narrow range of conditions by frequent low-severity fire. These forests do not undergo distinct successional stages unless fire is suppressed.
  - Wet mixed conifer forests undergo forest successional stages from early to climax conditions based upon plant establishment and development under competition over longer time periods. Infrequent, high-severity fire resets climax stages to early succession.

Mixed Conifer Forests

- grouped by species & characteristic functions

- Forest composition and associations
  - Dry mixed conifer forests are typically more open and dominated by shade intolerant/fire resistant species when the characteristic frequent fire regime is present. (Typically ponderosa pine, white pine, Douglas-fir).
  - Wet mixed conifer forests are dominated by shade intolerant species during early succession (Douglas-fir, white pine, aspen). Ponderosa pine is usually absent or insignificant. Forests become closed canopy and dominated with shade intolerant/ non fire resistant species during later succession.

Relative shade and fire tolerance of common conifer tree species in mixed conifer and spruce-fir forests



Plant Associations (habitat types)*

- Douglas-fir series:
  - dry mixed conifer (bunchgrass and shrub associations)
- White fir series:
  - Dry mixed conifer (bunchgrass plant associations)
  - Wet mixed conifer (most shrub plant associations)
- Blue and Engelmann spruce series:
  - Dry mixed conifer (blue spruce/bunchgrass associations)
  - Wet mixed conifer (blue spruce/shrub and Engelmann spruce associations)

* Grouped by species assemblages. Classified by the most shade tolerant species successfully reproducing on site.

Plant Associations

- Frequent Fire Mixed Conifer

FREQUENT FIRE (DRY) MIXED CONIFER		
HT_CODE*	COMMON_NAME	SCIENTIFIC_NAME
1203	Douglas-fir/creeping barberry	PSME/MARE11
1213	Douglas-fir/mountain ninebark	PSME/PHMO4
12140	Douglas-fir/Gambel oak	PSME/QUGA
12141	Douglas-fir/Gambel oak/Arizona fescue	PSME/QUGA/FEAR2
12142	Douglas-fir/Gambel oak/screwleaf muhly	PSME/QUGA/MUVI2
12143	Douglas-fir/Gambel oak/rockspirea	PSME/QUGA/HODU
1231	Douglas-fir/kinnikinnik	PSME/ARUV
12320	Douglas-fir/fringed brome	PSME/BRCI2
12330	Douglas-fir/Arizona fescue	PSME/FEAR2
12331	Douglas-fir/Arizona fescue/bristlecone pine	PSME/FEAR2/PIAR
12332	Douglas-fir/Arizona fescue/limber pine	PSME/FEAR2/PIFL2
12333	Douglas-fir/Arizona fescue/quaking aspen	PSME/FEAR2/POTR5
12340	Douglas-fir/mountain muhly/twoneedle pinyon	PSME/MUMO/PIED
12341	Douglas-fir/mountain muhly/limber pine	PSME/MUMO/PIFL2
12350	Douglas-fir/screwleaf muhly	PSME/MUVI2
12360	Douglas-fir/silverleaf oak/ponderosa pine	PSME/QUHY/PIPO
12361	Douglas-fir/silverleaf oak/Chihuahua pine	PSME/QUHY/PILE
12362	Douglas-fir/silverleaf oak/netleaf oak	PSME/QUHY/QURU4
12380	Douglas-fir (scree)	PSME
1239	Douglas-fir/bigtooth maple	PSME/ACGR3
1241	Douglas-fir/rockspirea	PSME/HODU
12420	Douglas-fir/wavyleak oak	PSME/QUPA4
12430	Douglas-fir/Arizona white oak	PSME/QUAR

Plant Associations

- Frequent Fire Mixed Conifer (continued)

FREQUENT FIRE (DRY) MIXED CONIFER		
HT_CODE*	COMMON_NAME	SCIENTIFIC_NAME
1020	white fir/creeping barberry	ABCO/MARE11
1021	white fir/creeping barberry/New Mexico locust	ABCO/MARE11/RONE
1022	white fir/creeping barberry/common juniper	ABCO/MARE11/JUCO6
1040	white fir/Arizona fescue	ABCO/FEAR2
1041	white fir/Arizona fescue/muttongrass	ABCO/FEAR2/POFE
1042	white fir/Arizona fescue/Gambel oak	ABCO/FEAR2/QUGA
1050	white fir/Gambel oak	ABCO/QUGA
1051	white fir/Gambel oak/screwleaf muhly	ABCO/QUGA/MUVI2
1052	white fir/Gambel oak/Arizona fescue	ABCO/QUGA/FEAR2
1053	white fir/Gambel oak/pine muhly	ABCO/QUGA/MUDU
1054	white fir/Gambel oak/rockspirea	ABCO/QUGA/HODU
1060	white fir/screwleaf muhly	ABCO/MUVI2
1070	white fir/Nevada pea	ABCO/LALAL3
1090	white fir/kinnikinnik	ABCO/ARUV
1110	white fir/New Mexico locust	ABCO/RONE
1111	white fir/New Mexico locust/dryspike sedge	ABCO/RONE/CAFO3
1130	white fir/Arizona walnut	ABCO/JUMA
1140	white fir/mountain snowberry/ponderosa pine	ABCO/SYOR2/PIPO
1141	white fir/mountain snowberry/limber pine	ABCO/SYOR2/PIFL2
6060	blue spruce/dryspike sedge	PIPU/CAFO3
6090	blue spruce/Arizona fescue	PIPU/FEAR2

Plant Associations
- Infrequent Fire Mixed Conifer

INFREQUENT FIRE (WET) MIXED CONIFER		
HT_CODE*	COMMON_NAME	SCIENTIFIC_NAME
240300	limber pine/kinnikinnik	PIFL2/ARUV
1010	white fir/Rocky Mountain maple	ABCO/ACGL
1011	white fir/Rocky Mountain maple/creeping barberry	ABCO/ACGL/MARE11
1012	white fir/Rocky Mountain maple/rockspirea	ABCO/ACGL/HODU
1013	white fir/Rocky Mountain maple (riparian)	ABCO/ACGL
1030	white fir/sprucefir fleabane	ABCO/EREX4
1080	white fir/bigtooth maple	ABCO/ACGR3
1081	white fir/bigtooth maple/rockspirea	ABCO/ACGR3/HODU
1120	white fir/beardless wildrye	ABCO/LETR5
1160	white fir/burnet ragwort	ABCO/PASA12
1150	white fir/dryspike sedge	ABCO/CAFO3
6010	blue spruce/redosier dogwood	PIPU/COSES
6070	blue spruce/sprucefir fleabane	PIPU/EREX4
6071	blue spruce/sprucefir fleabane/ponderosa pine	PIPU/EREX4/PIPO
6080	blue spruce/kinnikinnik	PIPU/ARUV
6130	blue spruce/bittercress ragwort	PIPU/PACA34
11	blue spruce (riparian)	PIPU

Plant Associations
- Infrequent Fire Mixed Conifer

SPRUCE-FIR DOMINATED MIXED CONIFER (LOWER SUB-ALPINE), Infrequent fire		
HT_CODE*	COMMON_NAME	SCIENTIFIC_NAME
4060	Engelmann spruce/moss	PIEN/2MOSS
4061	Engelmann spruce/moss/Engelman spruce	PIEN/2MOSS/PIEN
4062	Engelmann spruce/moss/Douglas-fir	PIEN/2MOSS/PSME
415	Engelmann spruce/whortleberry/Jacob's-ladder	PIEN/VAMY2/POPUD3
4151	Engelmann spruce/whortleberry/Jacob's-ladder/Engelmann spruce	PIEN/VAMY2/POPUD3/PIEN
4152	Engelmann spruce/whortleberry/Jacob's-ladder/subalpine fir	PIEN/VAMY2/POPUD3/ABLA
4300	Engelmann spruce/Rocky Mountain maple	PIEN/ACGL
4310	Engelmann spruce/sprucefir fleabane	PIEN/EREX4
4320	Engelmann spruce/beardless wildrye	PIEN/LETR5
4330	Engelmann spruce/Ross' avens	PIEN/GERO2
4340	Engelmann spruce/gooseberry currant	PIEN/RIMO2
435	Engelmann spruce/bittercress ragwort	PIEN/PACA34
4350	Engelmann spruce/bittercress ragwort/subalpine fire	PIEN/PACA34/ABLAL
4351	Engelmann spruce/bittercress ragwort/white fir	PIEN/PACA34/ABCO
4360	Engelmann spruce/whortleberry	PIEN/VAMY2
604	blue spruce/twinflower	PIPU/LIBO3
1100	white fir/whortleberry	ABCO/VAMY2

Development of R3 Desired Conditions

- History of development
  - DC developed for Forest Plan Revision
  - Iterative and adaptive process
- DCs guide project level development
- Based on best available science for forest ecology, wildlife ecology, natural range of variability, etc.

Mixed Conifer Forest Characteristics

- the basis for Forest Plan Desired Conditions

Forest Type (sub-type)	Fire Regime		Fire Type	Forest Structure	Seral Species	Climax Species
	Fire Frequency	Fire Severity				
Dry mixed-conifer (warmer/drier)	Regime I (common) 0-35 years	Low	Surface	Uneven-aged, grouped, open	Dominant: ponderosa pine Subdominant: aspen and/or oak (in sub-stand scale patches)	Shade-intolerant species under fire dis-climax historic conditions. Dominant: ponderosa pine Subdominant: Douglas-fir and Southwestern white pine or limber pine
	Regime III (rare) 35-100+ years	Mixed	Mixed	Uneven-aged, patched, open		
Wet mixed-conifer (cooler/wetter)	Regime III (common) 35-100+ years	Mixed	Mixed	Uneven-aged, patched, closed	Dominant (depending on habitat type): aspen or Douglas-fir	Shade tolerant species. Dominant (depending on habitat type): white fir and/or blue spruce
	Regime IV (rare) 35-100+ years	High	Stand-replacing	Even-aged, closed		

Forest Plan Desired Conditions
- key elements

- Tree species composition:
  - Dry mixed conifer – maintain dominance of shade intolerant, fire resistant species. Other species are present, but sub-dominant.
  - Wet mixed conifer – maintain a balance of forest successional stages across the landscape in stand-scale (and larger) patches. The landscape will be a mix of early-mid-late successional species (shade-intolerant to shade tolerant) occurring in large patches.

Forest Plan Desired Conditions
- key elements

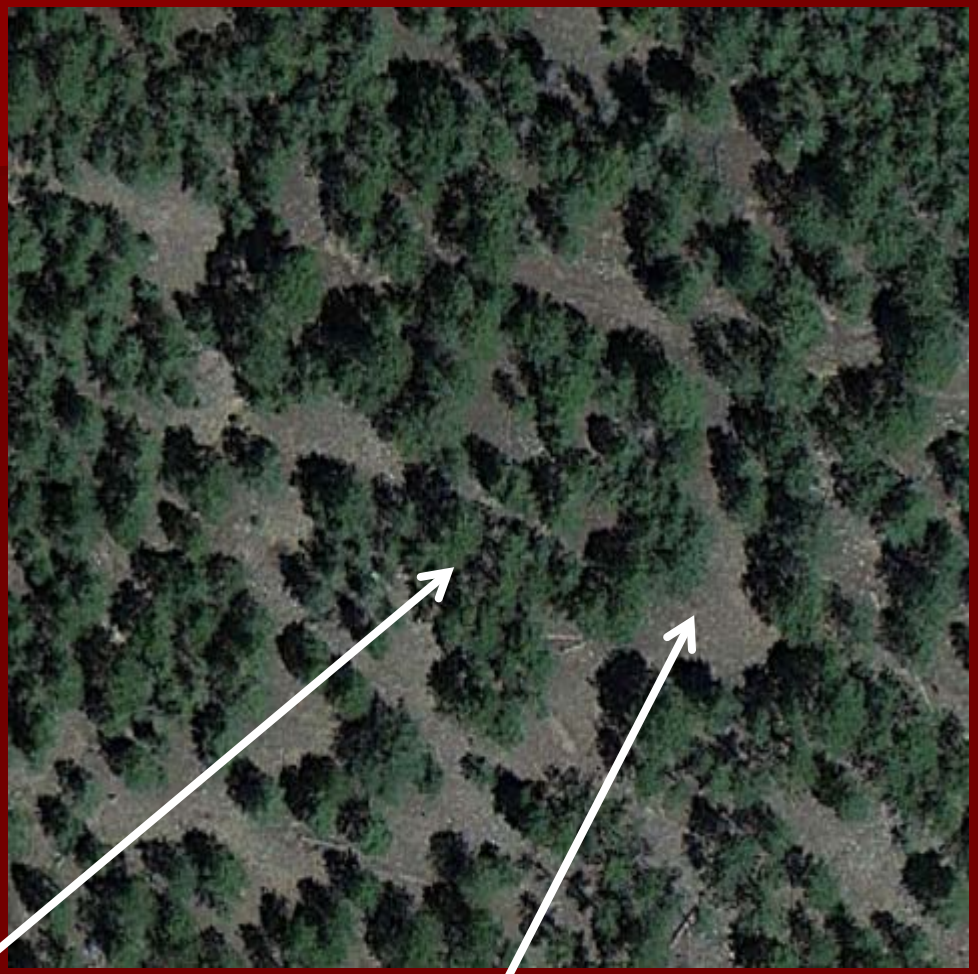
- Tree structure/age:
  - Dry mixed conifer – sustain mix of tree structural stages (ages) at the sub-stand scale. Typically as individual trees and tree groups interspaced with grass/forb/shrub patches (open forest).
  - Wet mixed conifer – sustain mix of tree structural stages (ages) at the landscape scale. Typically as relatively homogenous even-aged patches and stand-scale units (closed forest, except during early succession).

Forest Plan Desired Conditions
- key elements

- Processes and Functions*:
  - Biological diversity, foodwebs, hydrologic processes, nutrient recycling, etc.
  - Disturbances (fire, insects, disease, windthrow) at natural frequencies and levels.

* Desired conditions for processes and functions vary by forest type to reflect the characteristic ecological processes.

Openness and Variability



Area under tree cover

Interspace grass/forb/shrub

Wet mixed conifer or North-facing slope example:

About 30-40% of area is open grass/ forb/ shrub interspace

About 60-70% of area is under mid-old tree cover

Openness and Variability

Dry mixed conifer or South-facing slope example:

About 40-60% of area is open grass/ forb/ shrub interspace

About 40-60% of area is under mid-old tree cover

Links between desired conditions and ecological restoration

- The Desired Conditions fall within natural historic conditions
- Natural conditions are a good example of functioning, sustainable, and resilient ecosystems
- Attaining the Desired Conditions will achieve restoration objectives

Key Message

- Mixed conifer forests occur on a bio-physical gradient between warm/dry ponderosa pine forests and cold/wet spruce-fir forests.

- All of these forest types intergrade. On some landscapes, this intergrade is distinct, formed by features such as aspect and elevation. However in other locations these intergrades may be small-scale and subtle, reflective of local changes in ecological site conditions.

- Management prescriptions and guidelines must be adaptable and flexible to accommodate variation at local scales, facilitating appropriate management at all scales.

James A. Youtz

USFS Southwestern Regional Silviculturist