








# **Unit I**

## **Introduction to the 40 Fuel Models**

# NIFTT

http://www.frames.gov/portal/server.pt/community/nifft/382/training/1659

Web Hosting by:  FRAMES Home ▾ Subject Areas ▾ Geographic Areas ▾ Partner Sites ▾ MyFRAMES Log In

 National Interagency Fuels, Fire, and Vegetation Technology Transfer (NIFTT)   

Partner Sites > NIFTT > Training

Online Training Courses

**\*NEW\*** We now have a new and improved host for our courses.

**Learn how to Register for and Navigate NIFTT Courses**

After viewing the above presentation, click here to [Register for a NIFTT course](#).

We welcome your questions and comments.  
Please contact us at [helpdesk@nifft.gov](mailto:helpdesk@nifft.gov)

<b>Introduction to the 40 Fire Behavior Fuel Models</b>	<a href="#">Course Outline</a>	3 hours
<b>Using Fire Behavior Nomographs to Estimate Fire Behavior Characteristics</b>	<a href="#">Course Outline</a>	3 hours
<b>Introduction to the Fuel Characteristic Classification System (FCCS) Version 2.0</b>	<a href="#">Course Outline</a>	4 hours
<b>Area Change Tool (ACT)</b>	<a href="#">Course Outline</a>	3 hours
<b>First Order Fire Effects Model Mapping Tool (FOFEMMT)</b> - Note: FOFEMMT will be replaced by the Wildland Fire Assessment Tool (WFAT) in 2011.	<a href="#">Course Outline</a>	3.5 hours
<b>Fire Regime Condition Class Mapping Tool (FRCCMT)</b> - Note: FRCCMT is currently being redesigned. The new version of the tool will be available in 2011.	<a href="#">Course Outline</a>	4 hours
<b>*New* Fuel Loading Models (FLM)</b> - Introduces a fire effects model classification system and its applications.	<a href="#">Course Outline</a>	1.5 hours

-----

The below courses are still offered through our previous host  
To register for these courses, click [here](#).

**Left Sidebar:**

- ▼ NIFTT
- Home
- About NIFTT
- Training Registration
- Training
- FAQs
- Tools and User Documents
- Other NIFTT Resources
- NIFTT Archived Resources
- Learning Pathways
- Presentation Library
- Citing NIFTT Tools
- Partners
- Contact Us

Search the Resource Catalog:

**Related Sites**

- [Fire.org](#)
- [Fire Regime Condition Class \(FRCC\)](#)
- [LANDFIRE](#)
- [NWCWG Fuels Management Committee](#)
- [Vegetation Dynamics Development Tool \(VDDT\)](#)



# What is a model?

- A device used to emulate the real world



## What is a fuel model?

- Set of fuelbed characteristic inputs needed by a fire model



# What is a fuel model?

- Set of fuelbed characteristic inputs needed by a fire model

## **Fuelbed inputs:**

- Fuel load by size class
- Bulk density
- Fuel particle size
- Heat content
- Extinction moisture content



Table 7—Fuel model parameters.

Fuel model code	Fuel load (t/ac)					Fuel model type <sup>a</sup>	SAV ratio (1/ft) <sup>b</sup>			Fuel bed depth (ft)	Dead fuel extinction moisture (percent)	Heat content BTU/lb <sup>c</sup>
	1-hr	10-hr	100-hr	Live herb	Live woody		Dead 1-hr	Live herb	Live woody			
GR1	0.10	0.00	0.00	0.30	0.00	dynamic	2200	2000	9999	0.4	15	8000
GR2	0.10	0.00	0.00	1.00	0.00	dynamic	2000	1800	9999	1.0	15	8000
GR3	0.10	0.40	0.00	1.50	0.00	dynamic	1500	1300	9999	2.0	30	8000
GR4	0.25	0.00	0.00	1.90	0.00	dynamic	2000	1800	9999	2.0	15	8000
GR5	0.40	0.00	0.00	2.50	0.00	dynamic	1800	1600	9999	1.5	40	8000
GR6	0.10	0.00	0.00	3.40	0.00	dynamic	2200	2000	9999	1.5	40	9000
GR7	1.00	0.00	0.00	5.40	0.00	dynamic	2000	1800	9999	3.0	15	8000
GR8	0.50	1.00	0.00	7.30	0.00	dynamic	1500	1300	9999	4.0	30	8000
GR9	1.00	1.00	0.00	9.00	0.00	dynamic	1800	1600	9999	5.0	40	8000
GS1	0.20	0.00	0.00	0.50	0.65	dynamic	2000	1800	1800	0.9	15	8000
GS2	0.50	0.50	0.00	0.60	1.00	dynamic	2000	1800	1800	1.5	15	8000
GS3	0.30	0.25	0.00	1.45	1.25	dynamic	1800	1600	1600	1.8	40	8000
GS4	1.90	0.30	0.10	3.40	7.10	dynamic	1800	1600	1600	2.1	40	8000
SH1	0.25	0.25	0.00	0.15	1.30	dynamic	2000	1800	1600	1.0	15	8000
SH2	1.35	2.40	0.75	0.00	3.85	N/A	2000	9999	1600	1.0	15	8000
SH3	0.45	3.00	0.00	0.00	6.20	N/A	1600	9999	1400	2.4	40	8000
SH4	0.85	1.15	0.20	0.00	2.55	N/A	2000	1800	1600	3.0	30	8000
SH5	3.60	2.10	0.00	0.00	2.90	N/A	750	9999	1600	6.0	15	8000
SH6	2.90	1.45	0.00	0.00	1.40	N/A	750	9999	1600	2.0	30	8000
SH7	3.50	5.30	2.20	0.00	3.40	N/A	750	9999	1600	6.0	15	8000
SH8	2.05	3.40	0.85	0.00	4.35	N/A	750	9999	1600	3.0	40	8000
SH9	4.50	2.45	0.00	1.55	7.00	dynamic	750	1800	1500	4.4	40	8000
TU1	0.20	0.90	1.50	0.20	0.90	dynamic	2000	1800	1600	0.6	20	8000
TU2	0.95	1.80	1.25	0.00	0.20	N/A	2000	9999	1600	1.0	30	8000
TU3	1.10	0.15	0.25	0.65	1.10	dynamic	1800	1600	1400	1.3	30	8000
TU4	4.50	0.00	0.00	0.00	2.00	N/A	2300	9999	2000	0.5	12	8000
TU5	4.00	4.00	3.00	0.00	3.00	N/A	1500	9999	750	1.0	25	8000
TL1	1.00	2.20	3.60	0.00	0.00	N/A	2000	9999	9999	0.2	30	8000
TL2	1.40	2.30	2.20	0.00	0.00	N/A	2000	9999	9999	0.2	25	8000
TL3	0.50	2.20	2.80	0.00	0.00	N/A	2000	9999	9999	0.3	20	8000
TL4	0.50	1.50	4.20	0.00	0.00	N/A	2000	9999	9999	0.4	25	8000
TL5	1.15	2.50	4.40	0.00	0.00	N/A	2000	9999	1600	0.6	25	8000
TL6	2.40	1.20	1.20	0.00	0.00	N/A	2000	9999	9999	0.3	25	8000
TL7	0.30	1.40	8.10	0.00	0.00	N/A	2000	9999	9999	0.4	25	8000
TL8	5.80	1.40	1.10	0.00	0.00	N/A	1800	9999	9999	0.3	35	8000
TL9	6.65	3.30	4.15	0.00	0.00	N/A	1800	9999	1600	0.6	35	8000
SB1	1.50	3.00	11.00	0.00	0.00	N/A	2000	9999	9999	1.0	25	8000
SB2	4.50	4.25	4.00	0.00	0.00	N/A	2000	9999	9999	1.0	25	8000
SB3	5.50	2.75	3.00	0.00	0.00	N/A	2000	9999	9999	1.2	25	8000
SB4	5.25	3.50	5.25	0.00	0.00	N/A	2000	9999	9999	2.7	25	8000

<sup>a</sup> Fuel model type does not apply to fuel models without live herbaceous load.



# What is a fuel model?

- Set of fuelbed characteristic inputs needed by a fire model
  - Fire behavior fuel models
  - NFDRS fuel models
  - Fuel loading models
  - FCCS fuelbed



# What is a fuel model?

- Set of fuelbed characteristic inputs needed by a fire model
  - Fire behavior fuel models
  - NFDRS fuel models
  - Fuel loading models
  - FCCS fuelbed

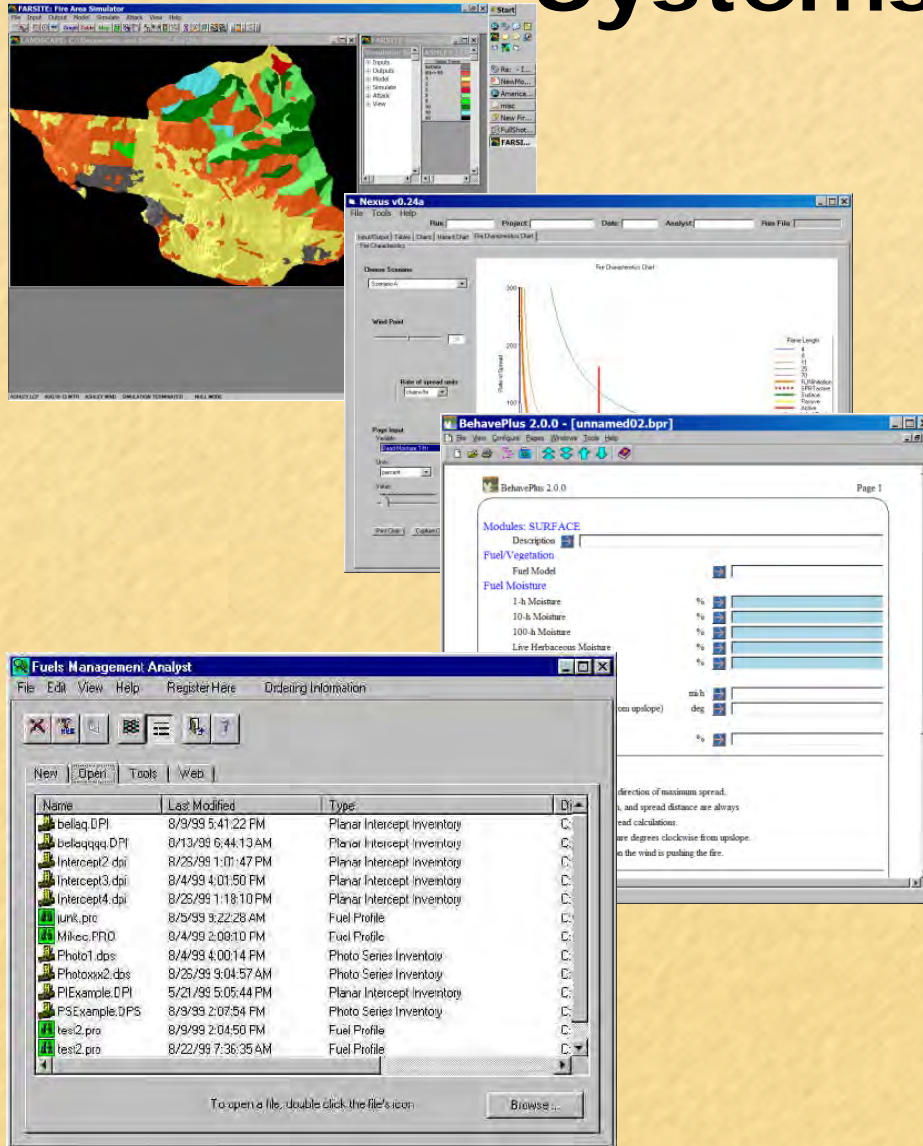




## Why the 40 Fuel Models?

- More Fuel Model Choices
- Less Gaps
- Better Suited for predicting post treatment fire behavior
- Cover a wider range of seasons
- Better drives crown fire initiation models
- Reduced need for custom fuel models

# Systems



- BehavePlus
- FARSITE
- FlamMap
- FSPRO
- FFE-FVS
- NEXUS
- BEHAVE by Remsoft
- FMPlus

# History

Table 1.--Values for input parameters of 11 preliminary fuel models for the National Fire-Danger Rating System <sup>1</sup>

Fuel types	Total loading Tons/acre	Dead fuel						Living fuel		Fuel depth Ft.
		Fine		Medium		Large		$\sigma$ Ft. <sup>-1</sup>	$w_0$ Lb./ft. <sup>2</sup>	
		$\sigma$ Ft. <sup>-1</sup>	$w_0$ Lb./ft. <sup>2</sup>	$\sigma$ Ft. <sup>-1</sup>	$w_0$ Lb./ft. <sup>2</sup>	$\sigma$ Ft. <sup>-1</sup>	$w_0$ Lb./ft. <sup>2</sup>			
Grass (short)	0.75	3,500	0.034	--	--	--	--	--	--	1.0
Grass (tall)	3.0	1,500	.138	--	--	--	--	--	--	2.5
Brush (not chaparral)	6.0	2,000	.046	109	0.023	--	--	1,500	0.092	2.0
Chaparral	25.0	2,000	.230	109	.184	30	.092	1,500	.230	6.0
Timber (grass and understory)	4.0	3,000	.092	109	.046	30	.023	1,500	.023	1.5
Timber (litter)	15.0	2,000	.069	109	.046	30	.115	--	--	0.2
Timber (litter and understory)	30.0	2,000	.138	109	.092	30	.230	1,500	.092	1.0
Hardwood (litter)	15.0	2,500	.134	109	.019	30	.007	--	--	0.2
Logging slash (light)	40.0	1,500	.069	109	.207	30	.253	--	--	1.0
Logging slash (medium)	120.0	1,500	.184	109	.644	30	.759	--	--	2.3
Logging slash (heavy)	200.0	1,500	.322	109	1.058	30	1.288	--	--	3.0

<sup>1</sup> For all models  $S_t = 0.0555$ ,  $S_e = 0.010$ ,  $h = 8,000$  B.t.u./lb.,  $\rho_b = 32.0$  lb./ft.<sup>3</sup>,  $(M_x)_{dead} = 0.30$ ,  $(M_x)_{living}$  determined by equation 88.

# History

Table 7.--Description of fuel models used in constructing the nomographs

Model	Typical fuel complexes	Surface-to-volume ratio (ft <sup>-1</sup> )/Loading (lb/ft <sup>2</sup> )				Depth (ft)	Moisture of extinction, dead fuel (percent)
		Dead fuel		Live fuel			
		1-h	10-h	100-h	(Foliage)		
GRASS AND GRASS-DOMINATED							
1	Short grass (1 ft)	3500/.034	--	--	--	1.0	12.74
2	Timber (grass and understory)	3000/.092	109/.046	30/.023	1500/.023	1.0	15 4.01
3	Tall grass (2.5 ft)	1500/.138	--	--	--	2.5	25 3.00
CHAPARRAL AND SHRUBFIELDS							
4	Chaparral (6 ft)	2000/.230	109/.184	30/.092	1500/.230	6.0	20 14.0
5	Brush (2 ft)	2000/.046	109/.023	--	1500/.092	2.0	20 3.5
6	Dormant brush, hardwood slash	1750/.069	109/.115	30/.092	--	2.5	25 6.01
7	Southern rough	1750/.052	109/.086	30/.069	1550/.017	2.5	40 2.88
TIMBER LITTER							
8	Closed timber litter	2000/.069	109/.046	30/.115	--	0.2	30 5.4
9	Hardwood litter	2500/.134	109/.019	30/.007	--	.2	25 3.48
10	Timber (litter and understory)	2000/.138	109/.092	30/.230	1500/.092	1.0	25 12.02
LOGGING SLASH							
11	Light logging slash	1500/.069	109/.207	30/.253	--	1.0	15 11.52
12	Medium logging slash	1500/.184	109/.644	30/.759	--	2.3	20 34.6
13	Heavy logging slash	1500/.322	109/1.058	30/1.288	--	3.0	25 58.1

# History

United States  
Department  
of Agriculture  
  
Forest Service  
  
Intermountain  
Forest and Range  
Experiment Station  
Ogden, UT 84401  
  
General Technical  
Report INT-122

April 1982



## Aids to Determining Fuel Models For Estimating Fire Behavior

Hal E. Anderson

This file was created by scanning the printed publication.  
Errors identified by the software have been corrected;  
however, some errors may remain.



# History

- Many fuel inputs have always been constant for all fuel models
  - 10-h and 100-h dead fuel SAV ratio
  - Total and effective mineral fraction
  - Owendry fuel particle density

- Designed to stand alone





- Designed to stand alone
- Original 13 still available







- Designed to stand alone
- Original 13 still available
- Specifies fuelbeds not vegetation



- Three-part naming convention



- Three-part naming convention
  - Fuel model code



- Three-part naming convention
  - Fuel model code
  - Fuel model number

fuel type	fuel model number block	used in original or new set	reserved for future standard fuel models	available for custom fuel models
	1-13	1-13		
	14-89			14-89
NB	90-99	91-93, 98-99	94-95	90, 96-97
GR	100-119	101-109	110-112	100, 113-119
GS	120-139	121-124	125-130	120, 131-139
SH	140-159	141-149	150-152	140, 153-159
TU	160-179	161-165	166-170	160, 171-179
TL	180-199	181-189	190-192	180, 193-199
SB	200-219	201-204	205-210	200, 211-219
	220-256			220-256

# Naming

fuel type	fuel model number block	used in original or new set	reserved for future standard fuel models	available for custom fuel models
	1-13	1-13		
	14-89			14-89
NB	90-99	91-93, 98-99	94-95	90, 96-97
GR	100-119	101-109	110-112	100, 113-119
GS	120-139	121-124	125-130	120, 131-139
SH	140-159	141-149	150-152	140, 153-159
TU	160-179	161-165	166-170	160, 171-179
TL	180-199	181-189	190-192	180, 193-199
SB	200-219	201-204	205-210	200, 211-219
	220-256			220-256

# Naming

fuel type	fuel model number block	used in original or new set	reserved for future standard fuel models	available for custom fuel models
	1-13	1-13		
	14-89			14-89
NB	90-99	91-93, 98-99	94-95	90, 96-97
GR	100-119	101-109	110-112	100, 113-119
GS	120-139	121-124	125-130	120, 131-139
SH	140-159	141-149	150-152	140, 153-159
TU	160-179	161-165	166-170	160, 171-179
TL	180-199	181-189	190-192	180, 193-199
SB	200-219	201-204	205-210	200, 211-219
	220-256			220-256

# Naming

fuel type	fuel model number block	used in original or new set	reserved for future standard fuel models	available for custom fuel models
	1-13	1-13		
	14-89			14-89
NB	90-99	91-93, 98-99	94-95	90, 96-97
GR	100-119	101-109	110-112	100, 113-119
GS	120-139	121-124	125-130	120, 131-139
SH	140-159	141-149	150-152	140, 153-159
TU	160-179	161-165	166-170	160, 171-179
TL	180-199	181-189	190-192	180, 193-199
SB	200-219	201-204	205-210	200, 211-219
	220-256			220-256

# Naming

fuel type	fuel model number block	used in original or new set	reserved for future standard fuel models	available for custom fuel models
	1-13	1-13		
	14-89			14-89
NB	90-99	91-93, 98-99	94-95	90, 96-97
GR	100-119	101-109	110-112	100, 113-119
GS	120-139	121-124	125-130	120, 131-139
SH	140-159	141-149	150-152	140, 153-159
TU	160-179	161-165	166-170	160, 171-179
TL	180-199	181-189	190-192	180, 193-199
SB	200-219	201-204	205-210	200, 211-219
	220-256			220-256



# Naming

## Three Part Naming Convention

- 1) Fire Model Code
- 2) Fuel Model Number
- 3) Fuel Model Name

***GR5 (105)***

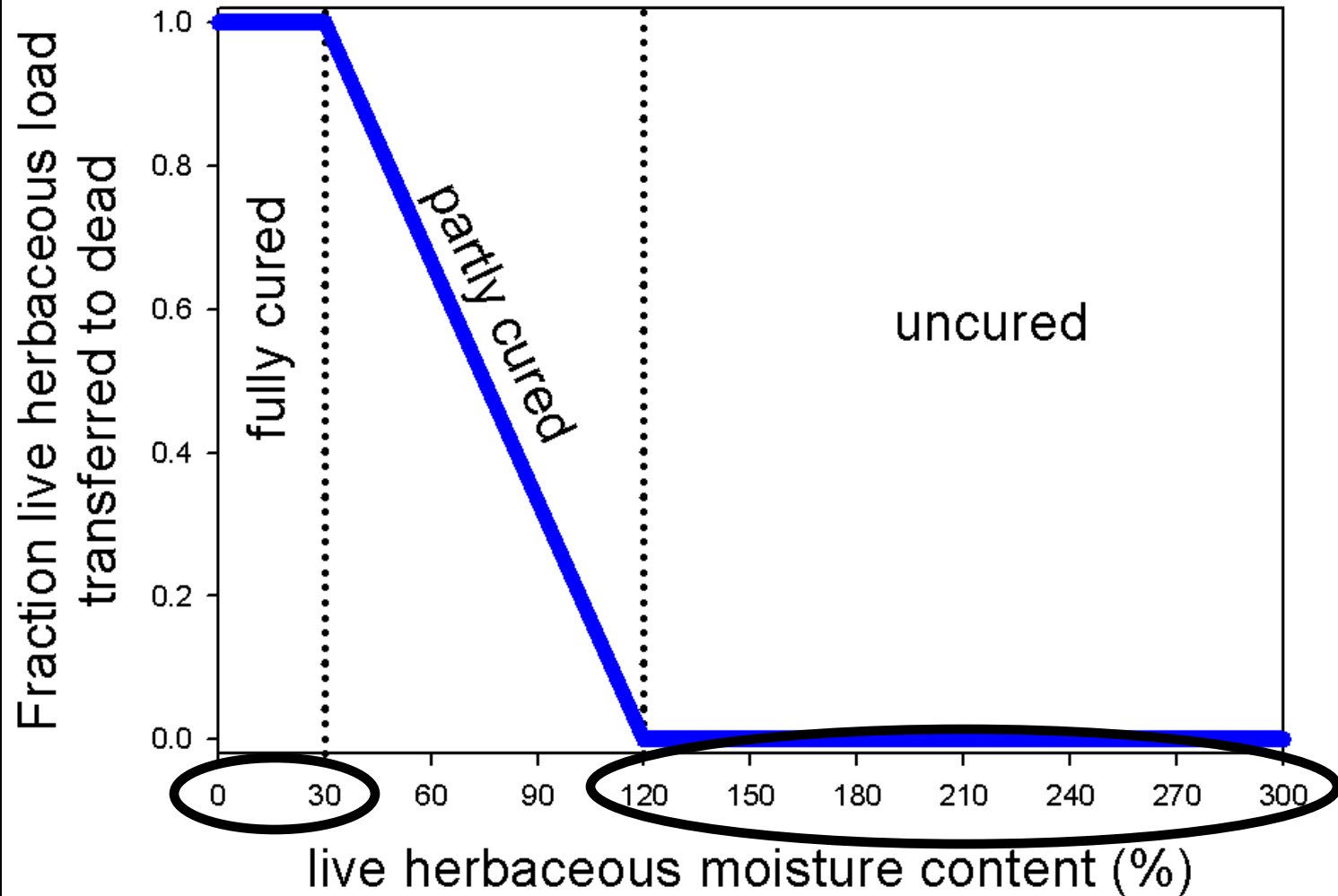
***Low Load, Humid Climate Grass (Dynamic)***

# Dynamic

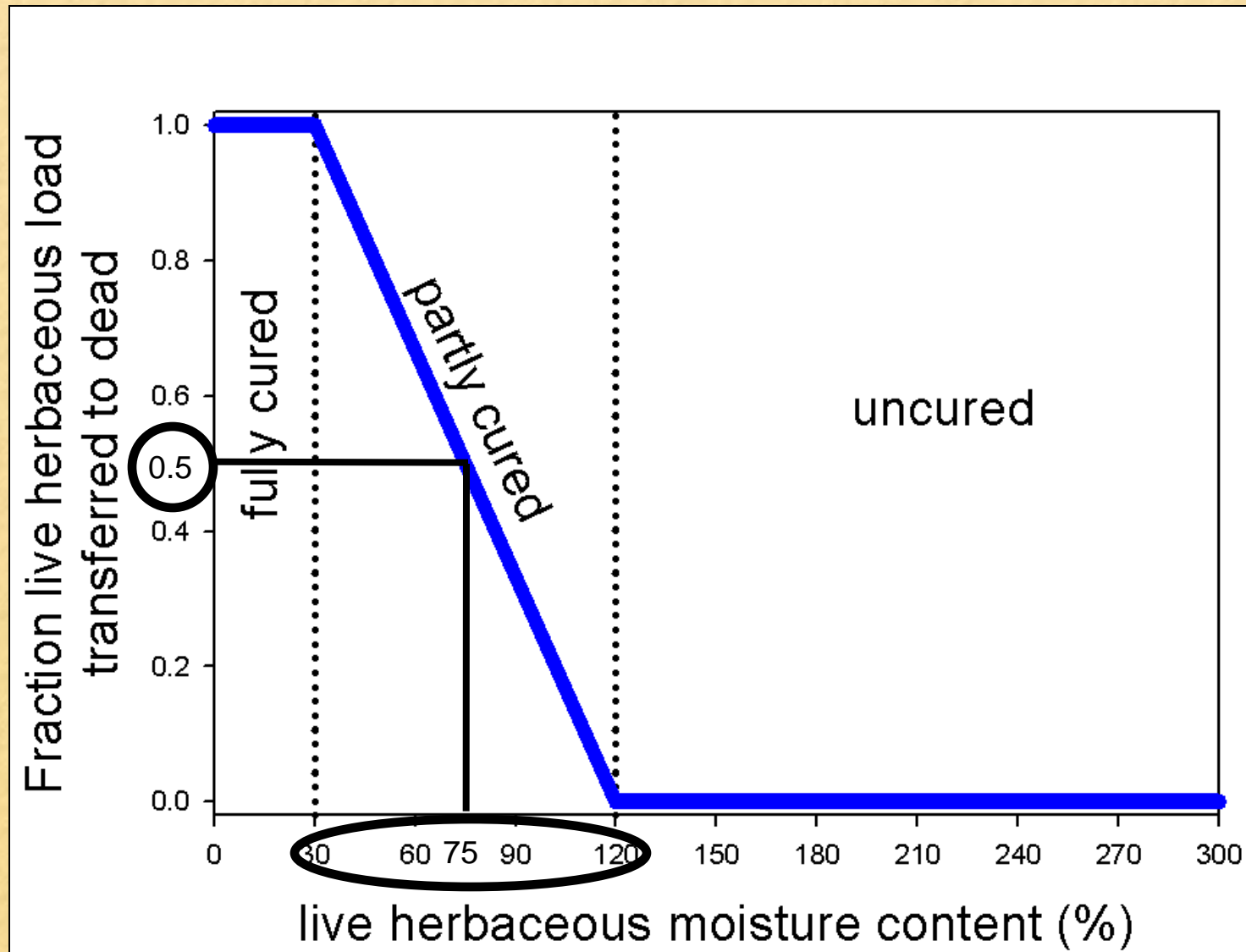
- Allocation of herbaceous load to live and dead



# Dynamic fuel models

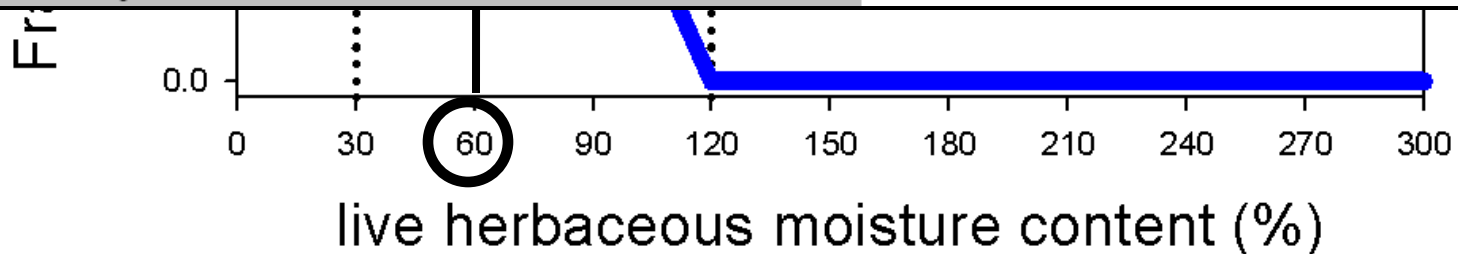


# Dynamic fuel models



# Dynamic fuel models

level of curing		live herbaceous moisture content
uncured	0 percent	120 percent or more
one-quarter	25	98
one-third	33	90
one-half	50	75
two-thirds	66	60
three-quarters	75	53
fully cured	100	30 or less



# Dynamic fuel models

- Allocation of herbaceous load to live and dead



# Dynamic fuel models

- Allocation of herbaceous load to live and dead
- Dead herbaceous load takes on dead 1-hr MC



# Dynamic fuel models

- Allocation of herbaceous load to live and dead
- Dead herbaceous load takes on dead 1-hr MC
- Dead herbaceous load is given the live herbaceous SAV ratio







## Dynamic fuel models

- Allocation of herbaceous load to live and dead
- Dead herbaceous load takes on dead 1-hr MC
- Dead herbaceous load is given the live herbaceous SAV ratio
- Increases ability (and difficulty)