



Lead Heavy Machinery Operations for Use at Vegetation Fires *Handouts*

Table of Contents

Exercise 1: RFMH Section 6	3
Exercise 1: RFMH Section 6 Model Answer.....	4
Exercise 2: RFMH Section 6	5
Exercise 2: RFMH Section 6 Model Answer	6
Exercise 3: Fire Behaviour - ROS	7
Rate of Spread Calculation Sheet	8
Exercise 3: Model Answer, ROS.....	9
Exercise 4: Productivity.....	10
Exercise 4: Productivity Model Answer.....	11
Tactical Planning Exercise – answer guidelines	12

Unit Standard 3292

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Exercise 1: RFMH Section 6

Situation 1 A fire is burning in 80% cured natural standing grazed pasture 0.25 m high on a 10 degree up-slope. ISI value is 5.

Determine the following expressed in the appropriate units of measure:

AFL (Available fuel load) = _____

FTROS (Flat terrain Rate of Spread) = _____

SCF (Slope Correction Factor) = _____

AROS (Adjusted Rate of Spread) = _____

HFI (Head Fire Intensity) = _____

FL (Flame Length) = _____

Tools Use your RFMH (*Green Book*) 6.4, 6.6, 6.7, 6.9 and 6.11.

Determine Adjusted Rate of Spread (AROS) – uses flat terrain ROS and SCF

Multiply flat terrain ROS by SCF to determine adjusted rate of spread (AROS)

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Exercise 1: RFMH Section 6 Model Answer

Situation 1 A fire is burning in 80% cured natural standing grazed pasture 0.25m high on a 10 degree up-slope. ISI value is 5.

Determine the following expressed in the appropriate units of measure:

- RFMH**
- 6.4 **AFL** (Available fuel load) = 2.0 t/ha
 - 6.6 **FTROS** (Flat terrain Rate of Spread) = 402 m/h
 - 6.7 **SCF** (Slope Correction Factor) = 1.6
 - AROS** (Adjusted Rate of Spread) = 643 m/h
 - 6.9 **HFI** (Head Fire Intensity) = 643 kW/m
 - 6.11 **FL** (Flame Length) = ~ 1.5 m – 1.5 m

RN page 24

Determine Adjusted Rate of Spread (AROS) – uses flat terrain ROS and SCF

- 6.7 Multiply flat terrain ROS by SCF to determine adjusted rate of spread (AROS)

RN page 25

Determining Headfire Intensity (HFI) – Rate of Spread/Fuel Load Relationship

- 6.9
- Tables use ROS in left hand column and AFL across the top to show Fire Intensity (I) expressed in kilowatts per metre (kW/m)
 - Consists of 3 tables – table number in bottom left hand corner of each table

	Table 1	Table 2	Table 3
	1 - 60 m/h ROS	80 - 1000 m/h ROS	1200 - 5000 m/h ROS

- e.g.
- AROS = 400 m/h
 - AFL = 10 t/ha
 - HFI = 2000 kW/m

- 6.10 **Determining Headfire Intensity (HFI) – Flame Length Relationship**

- Uses flame length expressed in metres to determine Actual and Approximate fire intensity

- e.g.
- FL = 2.0 m
 - HFI = ~ 1200 kW/m

Conversely...

- HFI = 5936 kW/m
- FL = ~ 4.0 m - 4.5 m

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Exercise 2: RFMH Section 6

Situation 2

A fire is burning in 80% cured natural standing grazed pasture 0.30 m high on a 15 degree up-slope. ISI value is 5.

Determine the following expressed in the appropriate units of measure:

AFL (Available fuel load) = _____

FTROS (Flat terrain Rate of Spread) = _____

SCF (Slope Correction Factor) = _____

AROS (Adjusted Rate of Spread) = _____

HFI (Head Fire Intensity) = _____

FL (Flame Length) = _____

Name:..... Organisation:.....

Exercise 2: RFMH Section 6 Model Answer

Situation 2 A fire is burning in 80% cured natural standing grazed pasture 0.3m high on a 15 degree up-slope. ISI value is 5.
Determine the following expressed in the appropriate units of measure:

AFL (Available fuel load)	=	2.2 t/ha
FTROS (Flat terrain Rate of Spread)	=	402 m/h
SCF (Slope Correction Factor)	=	2
AROS (Adjusted Rate of Spread)	=	804 m/h
HFI (Head Fire Intensity)	=	884 kW/m
FL (Flame Length)	=	~ 1.5 m – 2.0 m

Name:..... Organisation:.....

Exercise 3: Fire Behaviour - ROS

Time of day	Mid-week 1330	Time of Year	Mid January
ISI	= 6	BUI	= 48
Degree of Grass Curing = 80%			

- Situation**
1. A fire is reported in long rank grass on the Eastern side of a rural road, which at this point runs directly North-South. The fire is spreading into the adjacent farmland flats.
 2. 400m east of the road over the farm boundary fence is scrubland consisting of Manuka about 1.5m high on a 6° up-slope running some 300m to the ridgeline. On the eastern side of this ridge there is dense Manuka scrub about 1.5m high on a 10° down-slope.
 3. The vegetation on the farmland flats is predominantly un-grazed grass and weeds of around 0.4m in height.
 4. The wind direction is 200 degrees.
 5. The boundary fence between the farm and the scrub is entwined with large bushy Manuka scrub of around 2m in height.

Determine the following (write your answers on the table provided)

Your tasks

For grass area:

1. Headfire rate of spread
2. Headfire intensity
3. The time required for the fire to reach the farm / scrub boundary.

For scrub area over the fence:

4. Headfire rate of spread
5. Headfire intensity for the scrub area.
6. The time required for the fire to reach the ridgeline from the fence.

For scrub area over the ridge:

7. What fire intensity would you expect to occur after the fire crossed over the ridgeline?
8. How would this affect your tactics on this section of the fire?

Tip

These are field calculations!
Make it easier for yourself by rounding figures. You're looking for ballpark estimations.

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Rate of Spread Calculation Sheet

ISI = _____

BUI = _____

Degree of Grass Curing = _____ %

Rates of spread, headfire intensity, rates of perimeter growth, and elapsed time.

Distance (metres)	Slope (degrees)	Fuel Type	Fuel Height (metres)	Fuel Load (tonnes/ha)	Rate of Spread (ROS) (metres/hour)	Slope Correction Factor	Adjusted ROS (AROS) (metres/hour)	Headfire Intensity (kW/metre)	Time (minutes)
Grass area									
Scrub area									
							Total	Time to ridge	

References

Fuel Load Grass	RFM Handbook Sec 6.4	Fuel Load Manuka Scrub	RFM Handbook Sec 6.5
Headfire ROS, flat	RFM Handbook Sec 6.6	Slope Correction Factor	RFM Handbook Sec 6.7
Headfire Intensities	RFM Handbook Sec 6.9	Headfire Intensity / Flame Length	RFM Handbook Sec 6.10

(Time calculation = 60 ÷ AROS x distance.)

Name:..... Organisation:.....

Exercise 3: Model Answer, ROS

ISI = 6

BUI = 48

Degree of Grass Curing = 80 %

Rates of spread, headfire intensity, rates of perimeter growth, and elapsed time.

Distance (metres)	Slope (degrees)	Fuel Type	Fuel Height (Metres)	Fuel Load (tonnes/ha)	Rate of Spread (ROS) (metres/hour)	Slope Correction Factor	Adjusted ROS (AROS) (metres/hour)	Headfire Intensity (kW/metre)	Time (minutes)
Grass area									
400	Flat	UG Grass	0.4	5.5	532	0	532	1463	45
Scrub area									
300	6	Scrub	1.5	21.4	1491	1.3	1938	20,736	9
							Total	time to ridge	54 minutes

References

Fuel Load Grass	RFM Handbook Sec 6.4	Fuel Load Manuka Scrub	RFM Handbook Sec 6.5
Headfire ROS, flat	RFM Handbook Sec 6.6	Slope Correction Factor	RFM Handbook Sec 6.7
Headfire Intensities	RFM Handbook Sec 6.9	Headfire Intensity / Flame Length	RFM Handbook Sec 6.10

(Time calculation = $60 \div \text{AROS} \times \text{distance}$.)

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Exercise 4: Productivity

Productivity

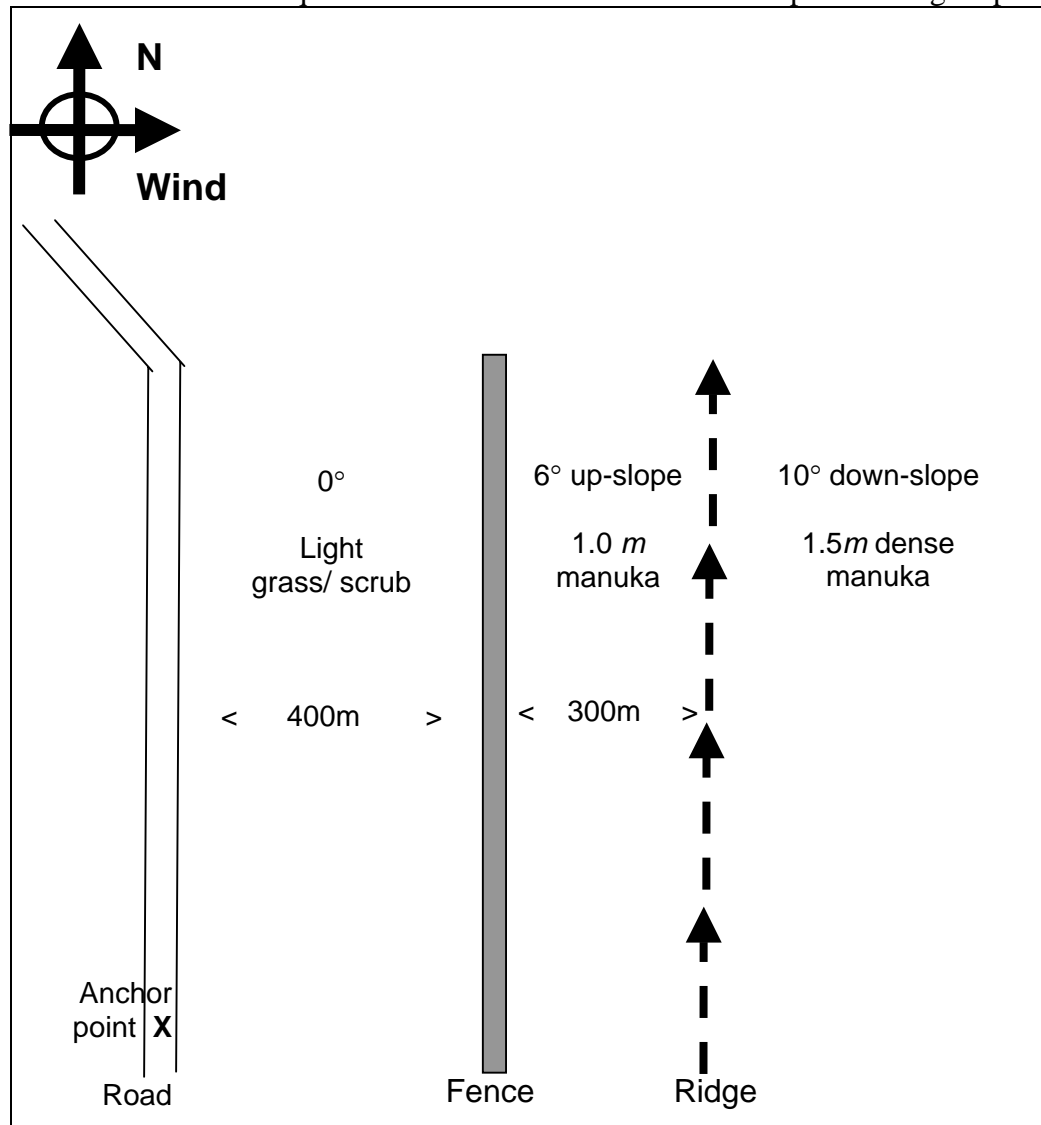
You are managing a sector at a fire. You need to construct a control line from an anchor point on a rural road using a D6 bulldozer assigned to you.

Fuel and topography information

The control line will traverse some 400m of scattered Manuka scrub and grass on flat ground and then through 300m of dense Manuka scrub about 1.0m high on a 6° slope running up to a ridgeline.

Your Task

Calculate the time required to establish a blade-width line up to the ridge top.



For

Machine productivity rates, see Referral Notes, pages 40 -42

Name:..... Organisation:.....

Exercise 4: Productivity Model Answer

Given

- 400 metres of light grass and scrub on flat ground
- 300 metres of dense Manuka scrub about 1.0 metre high on a 6° or 10% up-slope
- D6 Bulldozer

D6D rating = 104 kW

Fuel Resistance Class:

400 metres – Low

300 metres – Moderate

Productivity

4-6 m / kW/h – say 5 kW/h

2 m kW/h

Low resistance 5 m/kW/h = 520 m/h = 46 mins

Moderate resistance 2 m/kW/h = 208 m/h x 80% = 166 m/h = 108 mins

Total time = 154 mins = around 2.5 hrs

If the total line is in the Low Resistance Class.

Fuel Resistance Class:

Low resistance

Low resistance

5 m/kW/h = 520 m/h = 46 mins

5 m/kW/h = 520 m/h @ 80% = 416 m/h = 43 mins

Productivity

Total time = 89 mins = around 1.5 hrs

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Tactical Planning Exercise – answer guidelines

How did you go with your Tactical Planning exercise?

- Deploy bulldozer to construct a control line along the fence
In the event that the fire gets into the scrub, deploy a helicopter to provide flame knockdown ahead of the bulldozer and consolidate and patrol the line with hand crews.
- Request that the second helicopter be deployed to assist with the flame knockdown and foam application ahead of the bulldozer
- Request that a 4x4 engine be made available for follow up behind the dozer

Sector Objective	Contain the fire within the ridgeline using Direct Attack
Fire Assessment (perimeter growth and location)	2.5 x (ROS) 532 = 1330m Refer to RFMH, section 6, page 23 Rough Rules of Thumb
Resources Assigned (Production Capability) [will objective be met?]	Insufficient Without additional resources it can't be met.
Planned Deployment	Review

Safety Ask syndicate groups to identify safety issues and tasks...
(or as part of whole group debrief)

Discuss with students the process of arriving at these. e.g.

- Use of RFMH Sec 6
- Use of helicopter bucket productivity graph and bulldozer productivity information in Referral Notes