TECHNICAL RESOURCE MANUAL

FOR FARM FIRE RECOVERY

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Background

The Lower Eyre Peninsula "Black Tuesday" fire

On January 11, 2005, an extreme bushfire event swept across the Lower Eyre Peninsula region in South Australia. The fire burnt through approximately 83,000 hectares, about 80% of which was highly productive agricultural land used for cereal, oilseed and pulse grain production and extensive livestock grazing on improved pastures.

Study of fire impacts

In the wake of the fire, concerns were raised that its extreme intensity may have had a significant impact on the soils and their agricultural productive capacity. A monitoring program was put in place within days of the fire by Port Lincoln PIRSA staff in Rural Solutions SA and SARDI, to gather quantitative data from representative sites across the fire zone to assess effects on soils under agricultural production. This study continued through to 18 months post-fire, in June 2006.

The major conclusions from this study were that:

- **The effects of the burn on pasture regeneration and composition were only minimal.** Effects were variable, with higher plant numbers after burning at some sites, while reduced on others. But overall, no mass destruction of soil seed reserves was evident.
- **Effects on weed populations were also variable – no clearly defined changes or trends.**
- **Soil physical and chemical characteristics were largely unchanged due to the burn itself**, but subsequent erosion has removed some topsoil and nutrients with it.
- **Root pathogen populations at tested sites were low, with no evidence of a change on burnt ground.** Visual root inspection on wheat plants also showed no evidence of root diseases present.
- **But some diseases were still very prevalent after the fire (e.g. blackleg in canola and brown leaf spot in lupins),** indicating high survival of inoculum sources through the fire.
- **Late winter/ spring dry matter levels in regenerating pasture and crop appeared to be lower on burnt ground**, tied in with some observations of slower growth and possible N deficiency symptoms.
- **Grain yield and quality on burnt ground were as good as, if not better than on unburnt or pre-fire.** Our sole comparison of wheat grown on adjoining burnt and unburnt ground showed an 8% higher yield off the burnt, and higher grain protein levels, although soil type variations between the two areas may well explain this difference.

Farmer experiences and interviews

The major conclusions from this study were summarised in a questionnaire to farmers in the fire zone, to gain feedback on whether these findings were consistent with what they had observed on their fire-affected paddocks during 2005. Their responses showed a generally high level of agreement (70 to 100%) with the findings but some points of significant dissention. The major points of disagreement related to effects of the fire on pasture regeneration and composition, weeds present and grain yield from burnt areas – several farmers considered that their yields were significantly depressed on burnt paddocks.

Follow-up interviews were conducted with 15 farmers from across the fire zone in October 2007 to gather their views and experiences on technical aspects of their farm recovery, i.e. how well the land, crops and pastures had recovered after nearly 3 years, and the value of any management strategies they had adopted to restore agricultural productivity. Three agricultural advisors who worked closely with farmers through recovery from the fire were also interviewed.

The Farm Fire Recovery Manual

The need for an authoritative source of technical information on the impact of fire on agricultural land and what farmers could do to restore their land to full agricultural potential as quickly as possible became evident in the days and weeks following the Lower Eyre Peninsula fire. There was a wealth of experience on fire impacts and management for fire recovery scattered around Australia, but very fragmented and little documented in a readily retrievable form.

Thus we decided to produce a technical manual to bring together the findings and experience from the Lower Eyre Peninsula fire, with information gained from previous fires and fire–related research elsewhere. It is designed to be a resource for farmers, land managers, advisors and Government agencies responsible for coordinating emergency fire disaster relief measures, to assist in the fire recovery process at the farm level.

The Manual is relevant to southern Australian agricultural environments, i.e. those commonly known as Mediterranean and cool temperate climatic zones. These are regions with annual dryland cropping and grazed pastures that rely on a winter dominant rainfall pattern, with hot, dry summers that do not normally sustain annual pasture or crop growth at this time.

It aims to provide information to guide on-farm recovery management decisions in two phases:

1. **The critical first 48 hours after the fire** – priority is to care for livestock and take steps to minimise further land and vegetation damage.
2. **The longer term recovery and rebuilding phase** – key management issues and questions that farmers will need to address over the months following the fire, to return their paddocks to full production.

The Manual is not intended to be a recipe for farm recovery in all situations, but rather a checklist of issues and questions that farmers can expect to be faced with in the aftermath of a fire. It is a support, but not a substitute, for local knowledge, experience and advice.

Funding to develop the Manual was provided through the Lower Eyre Peninsula Bushfire Re-establishment Program (LEPBRP).

After the fire – the first 48 hours

The two immediate priorities for farm recovery after a major fire are to:

- Care for livestock
- Protect the land and vegetation from further damage.

Livestock care

State Agriculture/Primary Industries Departments provide assistance in livestock assessment, destruction and disposal following bushfire emergencies. Veterinary advice should also be sought for injured stock. Key elements in caring for livestock after the fire front has passed and it is safe to do so are:

- Assess all livestock exposed to the fire for burns and injury as soon as possible.
- Destroy all severely burnt and injured livestock (and native animals) quickly and humanely.
- Dispose of dead stock in an appropriate manner, to minimise disease risks and environmental impacts, e.g. on watercourses.
- Check that permanent or temporary fencing is adequate.
- Ensure that surviving stock have ready access to fresh water and quality feed, and are in a sheltered, shaded and quiet location.
- Place animals recovering from burns in a separate paddock or yard where they can be inspected regularly and nursed well.

More detailed information on burnt livestock assessment, treatment and management is available in the following publications:

- **Guidelines for the assessment of burnt stock**, Emergency Management Coordination Unit, PIRSA (Reference 1).
- **Assessing bushfire burns in livestock**, Primefact 399, NSW Department of Primary Industries (Reference 2).
- **Humane destruction of stock**, Primefact 310, NSW Department of Primary Industries (Reference 3).

Land and vegetation protection

Remove all stock from burnt areas as soon as possible. This is essential to:

- Retain what soil cover and pasture seed reserves still remain.
- Protect soil from further physical damage, especially lighter soil types.
- Prevent further damage to native and perennial vegetation and provide maximum opportunity for recovery, especially if there is some significant summer rainfall.

It is also preferable to stop grazing on directly adjacent unburnt pasture and stubble areas, to restrict soil movement from bare burnt areas and minimise weed invasion onto bare areas.

Complete removal of all stock from burnt farms is highly advisable where there has been significant loss of vegetation, soil cover, fences, watering facilities and other farm infrastructure. Advantages of sale or agistment of stock include:

- Minimising risk of further damage to soil and vegetation and improving recovery prospects, as outlined previously.
- Reduced risk of introduction of weeds with brought-in feed. Bare paddocks are particularly vulnerable to weed invasion and establishment.
- Opportunity to crop a larger proportion of the farm, to hasten restoration of soil cover and generate income.
- Land owners can focus their attention on farm recovery efforts, without the worry of livestock management, including hand feeding.

Livestock should not be returned or re-introduced until adequate soil cover has been re-established following autumn rains, and fences have been restored to a basic level to allow grazing management to prevent over-grazing and protect native vegetation, creeklines, etc.

The road to recovery:
Key management issues for farm managers following a major fire

All my soil cover has been burnt. How can I protect the soil from further damage?

The most urgent action is to remove all livestock from burnt paddocks. Even paddocks only partly burnt should be rested, as bare areas will act as a magnet to stock and the remaining soil cover in other parts of the paddock will assist in slowing wind speed at ground level and trap drifting soil particles.

The general principle for protecting bare burnt soil is to **do nothing** – leave paddocks alone until they have received sufficient rain to stimulate pasture germination or to allow crop or pasture sowing with minimal disturbance. In some situations, the fire will have caused a crust to form on the soil surface, or plant root matter may still be intact just below the soil surface despite the above-ground residue being burnt off. Both these will provide some protection against further wind damage if left undisturbed.

But in contrast to this principle, a number of farmers on Lower Eyre Peninsula delved or clay spread on light sandy paddocks following the 2005 fire, and reported success in restricting further wind erosion loss. The critical success factors with this strategy were:

- Only useful on sandy soils where suitable clay is within 30 to 50 cm of the surface, and can be brought to the surface in clods. If subsoil brought up is loose, leave it alone.
- Clay spreading was also successful, where there was a nearby source of suitable clay.
- Delved or spread clay was not incorporated, but left in rough clods or ridges on the surface. The rougher the better to interrupt wind flow at the soil surface.
- This was done on soil types where delving and clay spreading have been shown to have other long-term benefits, including reducing water repellance and improving water holding capacity of soil.
- Deep ripping also proved useful on heavier soils (not sands) where clods could be left on the surface. Rip lines were 1.2 to 2 m apart.

General principles and guidelines on delving and clay spreading are given in the PIRSA publication **Clay spreading and delving on Eyre Peninsula** (Reference 4).

The potential for water erosion on heavier soils left bare and possibly more water repellent as a result of fire is another issue facing managers. Construction of “dummy dams” upstream of existing farm dams can reduce the problem of excessive silt being washed into dams. This strategy was also employed successfully after the Lower Eyre Peninsula fire.

Do I need to resow my pastures, and how else can I encourage their recovery?

Loss of pasture seed reserves in a fire and subsequent regeneration are very variable. Buried seed, such as sub-clover, can survive even intense burns, as the heat of the fire only penetrates to a shallow depth in the soil (generally less than 20 mm). Surface seed, such as medic and grasses, is much more vulnerable to fire however, and high losses can occur.

The heat of the fire is a major factor influencing viable seed survival. This in turn is determined by fuel loads in the paddock, topography and weather conditions driving the fire. Fire heat can be grouped into four main classes:

- **Cool burn**. Most seeds will survive. There will be unburnt material left standing. This may happen with paddocks containing sparse plant material.

- **Moderate burn**. Some surface seeds will be affected. Buried seeds such as sub-clover should not be affected. A small amount of unburnt dead plant material may be left. This will happen in a hard grazed pasture.
- **Hot burn**. All plant material is burnt. Many surface seeds will be affected, plus possibly some buried seeds. Cocksfoot and perennial ryegrass will be affected. This will happen in a crop stubble or lightly grazed dry pasture.
- **Very hot burn**. All material is burnt, with surface soil organic matter destroyed. Buried seeds will be affected – although temperature below 15 mm depth won't increase by more than a few degrees. This will happen in windrows, under hay bales, in sheep camps and eucalypt shelter belts. Soils with very high organic matter levels may be burnt to 15 mm depth – but most soil will only be affected on the surface.

A further factor which may contribute to the loss of pasture seed reserves is subsequent wind or water erosion on burnt paddocks.

Annual pasture recovery following severe fire damage has often been good (better than many farmers expected), especially on heavily grazed paddocks where much seed is buried and the fire intensity is generally lower. Much depends on the opening to the next season – an early and clear break will get pastures off to a good start, even if the seed bank has been reduced.

Because of the high variability of residual germinable seed reserves in paddocks following fire, testing the level of reserves prior to the season break is advised, to provide guidance on the need to resow pastures or the option of cropping.

The amount of readily germinable seed reserves for pasture recovery can be estimated using "Carter" pasture rings in early autumn. Select areas representative of the whole paddock, and test different soil types separately. Old bore casings, car rims or cylindrical home water heater tanks can make suitable rings, provided they have a 30-40 cm diameter and height of 15 cm. A minimum of 10 rings per area is recommended to provide a reliable estimate of seed present.

Rings should be knocked into the soil to about half their height, leaving about 7.5 cm above ground. Gently fill the rings with water and cover with poly bags to reduce evaporation. Ensure the soil in the ring stays moist to encourage germination, by repeat waterings every 2-3 days if necessary – heavy clay soils will require more water than light sandy soils to wet up sufficiently. Count the number of germinated medic and/or clover and weeds after about 7 to 10 days, and convert to plants/m^2 with the formula:

Number of plants/m^2 = (Number per ring x 12,732) ÷ (ring internal diameter (cm))^2.

An alternative method that allows an earlier paddock assessment to be made (e.g. in February-March) is to take soil cores down to 5 cm from about 30 sites per paddock. Refrigerate these for a week to stimulate germination, then place in trays with drainage holes, water up and keep moist for 10 days, then count germinating seedlings.

A minimum of 100 pasture legume seedlings per m^2 is needed to get a productive pasture, although higher levels (1 seedling per mm average annual rainfall, or 400 seedlings/m^2 in a 400 mm annual rainfall district) should be targeted.

More detail on these pasture seed estimation techniques is given in the Rural Solutions SA ***Crop Monitoring Guide*** (see Reference 5).

Where pasture seed reserves are estimated to be below the optimum and soil cover has been lost, this will provide an opportunity for pasture renovation and resowing in autumn. Any soil disturbance should be kept to a minimum and as late as possible (just on the opening rains ideally!) to minimise the risk of wind erosion. A number of farmers took the opportunity of the Lower Eyre Peninsula fire to sow perennial pasture species, particularly lucerne and Italian

ryegrass. Aerial seeding or topdressing with balansa and subterranean clovers were also used to introduce new pasture legume varieties.

A low level of starter phosphorus fertilizer (5-10 kg P/ha) is advised for resowing pastures, especially on eroded soils which may have lost nutrients in fine soil particles. Inoculation of legume seed with the appropriate strain of root nodule bacteria (rhizobia) is also recommended, as an insurance against possible rhizobia reduction in the surface soil with intense heat.

Allow time for regenerating or sown pastures to provide good soil cover (at least 2-3 cm tall) before re-introducing grazing livestock. Grazing too early or too heavily will make it difficult for pastures to keep ahead of demand through winter, and thus jeopardise good seedset in spring and soil cover for the coming summer/autumn.

The notes above mainly relate to annual pastures. Information on perennial pasture recovery and management after fire is included in the NSW and Victorian Department of Primary Industries fact sheets on **Pasture recovery after fire** (References 6 and 7 respectively).

What will the fire have done to my soil, and how should I manage these effects?

Direct fire effects on soil physical, chemical and biological properties will vary with the heat that the soil has been exposed to, as discussed in the previous section. But significant heating of soil, to the extent likely to cause chemical changes such as loss of N, P or incorporated fine organic matter, is highly unlikely to be experienced beyond the top 15 mm or so in even the hottest burns in a cleared paddock. Much more significant changes in the soil will result from any subsequent loss of finer topsoil through wind or water erosion of the exposed soil surface. Hence the priority to minimise further soil damage after the fire and until new soil cover can be established.

Burning of the surface stubble cover, pasture residues and accumulated trash obviously is a loss of nutrients to the system, particularly organic matter, nitrogen (N), sulphur (S) and potassium (K). Burning a 2 tonne/ha cereal stubble results in an immediate loss of 10 kg N and 3 kg S in smoke, while 20 kg K and 1 kg P plus trace elements remain in the ash. But these nutrients are also lost if the ash blows away. The N and P losses through burning a similar cover of pasture residue (2 t/ha) are 6 times as great – i.e. 60 kg N and 6 kg P per ha.

Soil test results following a fire generally show little change in organic carbon, N and P levels where there has been no or only minimal subsequent loss of topsoil through drifting. In fact, the reverse has sometimes been observed, where a mild burn has resulted in a temporary flush of available nutrients, particularly N, through mineralisation from organic matter in and on the soil surface. Burning of non-legume crop and pasture residues may also make N more available in the next season as a result of reduced immobilisation. Hence the potential benefit of cropping all burnt paddocks to cereals in the first season after a fire event, to capitalise on the temporary nutrient flush.

The major nutritional problems reported by farmers following the Lower Eyre Peninsula fire were where wind erosion on burnt paddocks resulted in very significant topsoil loss – one farmer estimated that up to 5 cm of soil blew from some paddocks. Wind erosion selectively removes the finer soil particles which contain a higher proportion of nutrients, and leaves more coarse particles behind, resulting in a loss of surface soil structure and may cause surface crusting.

Despite the potential initial nutrient flush, nitrogen deficiency symptoms were observed later in the season at crop monitoring sites and also reported by farmers. Loss of soil cover and some topsoil organic matter may reduce N mineralisation during the growing season, leaving crops such as canola deficient late in the season. Several farmers reported difficulty in managing N delivery to

crops, due to the loss of organic matter and retained stubble. Soils may also become more prone to leaching of fertiliser N as a consequence of organic matter and soil structure loss. With this reduction in soil buffering capacity, it may be necessary to supply fertiliser N on a more regular basis through the growing season to crops. Several farmers considered that this was still a problem in the third year after the fire, and anticipated it would take 3 to 5 years to restore soil cover to pre-fire levels.

Phosphorus and trace element deficiencies (copper and zinc) were also suspected and managed on several burnt and eroded paddocks on Lower Eyre Peninsula.

The potential for nutrient loss, especially where significant erosion has also occurred, means that representative burnt areas should be soil tested for major nutrients (N, P, K, organic C) in autumn (March or April), to assist crop fertiliser decisions. Comparison with previous (pre-fire) soil tests for the same paddocks, or test results from nearby unburnt areas on similar soil types, will assist interpretation and decision-making.

Another direct effect of extreme heating by fire can be to make surface soil more water repellent, and shifting soil can also exacerbate the problem. An increase in non-wetting soils was not reported as a major issue following the Lower Eyre Peninsula fire, however.

What new weed problems can I anticipate and how should I manage these?

Soils laid bare by fire are very much at risk of invasion of weeds from nearby paddocks, roadsides and native vegetation areas. Farmers reported increased populations of a number of broadleaf weeds following the Lower Eyre Peninsula fire, notably:

- Wild radish (*Raphanus raphanistrum*)
- Salvation Jane or Paterson's curse (*Echium plantagineum*)
- Horehound (*Marrubium vulgare*)
- South African daisy (*Senecio pterophorus*)
- Sorrell (*Rumex acetosella*).

Reduced competition from regenerating pastures and lack of grazing allow weeds such as these the opportunity to gain a foothold in burnt paddocks. Careful monitoring and strategic control measures are the best defence against these weeds becoming long-term problems.

Brought-in feed for livestock, especially hay and baled straw, also carries the risk of introducing new weed species from other farms and districts. Removal of livestock from the farm until paddock feed recovers is therefore a sound strategy to eliminate this risk. But if this is not realistic or warranted, confining livestock to a small holding paddock for hand-feeding will reduce the risk of imported weeds escaping notice and becoming established.

A similar threat occurs when agisted livestock return. These should be hand-fed in a confined area for 2 to 3 weeks prior to turning out to graze in larger paddocks, to allow any weed seeds to be cleared from their digestive tract.

Fire also has direct effects on the populations of weeds present in the soil seed bank. Grasses which have more of their seed at or near the soil surface, including annual ryegrass, brome grass and barley grass, are reduced by hot to very hot burns. Other weed species including wild oats, wild radish and silver grass can show a flush of seedling numbers following burning, since more seed is buried and fire and smoke can break seed dormancy. As for pasture legume survival and regeneration, variable responses in weed populations have been observed with burning, and can be attributed to variations in many factors, including fire heat, the fuel load, whether pasture or crop stubble, intensity of grazing and the size of the seed bank.

The reduction of ryegrass with burning can present a management opportunity for cropping paddocks with a previously high herbicide resistant ryegrass population, as a first step towards longer term reduction in ryegrass numbers.

What management factors should I consider for this year's cropping program?

If livestock numbers have been reduced through mortality and/or moving off-farm, this provides the opportunity to increase crop area until stock numbers return to normal (pre-fire) levels.

Cropping burnt paddocks to cereals is a favoured option for a number of reasons, even though this may mean departing from planned rotations:

- Cereals will provide more rapid early growth and cover bare soil more quickly than pulses or canola. They are also less susceptible to being cut-off by sand-blasting in the seedling stage.
- Reduction of ryegrass and other grass seed reserves will make cereal management easier.
- Invading broadleaf weeds, such as wild radish, will be easier to detect and control in a cereal crop.
- Cereal crops will provide greater biomass production and therefore leave more stubble cover after harvest.
- Depending on the intensity and duration of the burn, there may be a reduction in some soil-borne root diseases such as crown rot and take-all that might normally limit re-cropping to cereals.
- Cereals generally require less financial outlay and are less risky in terms of yields and financial returns.

Grain stored in on-farm silos will have been potentially exposed to high temperatures in a fire and thus may have reduced germination and viability. Testing of grain intended for seed is therefore recommended – ensure that this includes samples taken from those areas likely to have experienced the highest temperatures, e.g. from adjacent to silo walls on the side facing the fire front or other source of intense and prolonged heat, such as burning trees. Seed tested from a number of silos in the fire path on Lower Eyre Peninsula all showed no germination problems, ranging from 93 to 100% germination. If germination is lowered significantly (e.g. to less than 90%), sowing rates should be adjusted to compensate or alternative seed obtained.

Lupins sown into bare burnt paddocks will run a higher than normal risk of brown leaf spot, due to the absence of stubble to limit spread of this disease by soil splash.

Pulse crops sown into burnt paddocks should be inoculated with the appropriate strain of rhizobial inoculum, as a precaution against the heat of the fire having sterilized the surface soil. This recommendation also applies to pasture legume seed sown into burnt soils.

Nitrogen management may be more difficult for canola in soils where surface residues have been destroyed and soil organic matter may be depleted by fire and/or subsequent erosion. Canola yields and quality will be more sensitive to any shortfall in N supply than cereals.

Extra care should be taken in using soil active herbicides such as simazine and atrazine on lighter soils with reduced surface residue and soil organic matter as a result of intense burning. This risk may restrict crop choice.

Crops should be sown with minimal soil disturbance, such as direct drilling with narrow points, to reduce the risk of further erosion.

Are any insect or other pest or disease problems likely to arise, and how should I manage these?

Depending on the intensity of the fire at the soil surface, some reduction in insect pests is likely. Farmers on Lower Eyre Peninsula reported that redlegged earthmite, millipedes, lucerne flea, aphids, slugs and snails were all less prevalent in crops and pastures during 2005, following the January fire.

There is also likely to have been sufficient heating of the top several cm of the surface soil to kill soil microflora. The depth of sterilisation will depend on the fire heat and duration, and soil type – sandy soils conduct heat better than clay. Hence some reduction in soil-borne diseases is possible, especially those where the pathogens are close to the soil surface, such as crown rot and to a lesser extent take-all. However, any reduction will be short-lived as there will be some recolonisation of the surface soil from below prior to the next crop, and from blown-in soil.

Soil pathogen levels were generally low (mostly below detection limits) in unburnt soils in the Lower Eyre Peninsula fire impact study, so it was not possible to conclusively measure a change in pathogens following the fire.

Blackleg in canola (*Leptosphaeria maculans*) and brown leaf spot in lupins (*Pleiochaeta setosa*) are major fungal diseases carried over on stubble and trash of these crops. Both diseases were still prevalent in crops in burnt paddocks on Lower Eyre Peninsula following the 2005 fire, indicating that sufficient stubble survived the fire to carry over spores to infect emerging crops. Thus normal disease control measures are advised, including selecting varieties with higher resistance ratings, using fungicidal seed dressings or fungicide-amended fertilisers, and maintaining rotational disease breaks.

As previously indicated, beneficial micro-organisms may also be killed by the heat of the fire. These include the soil rhizobia that form N-fixing nodules on legume roots. Therefore inoculation of pulse and pasture legume seed to be sown into burnt paddocks in the year following the fire, with the appropriate strain of rhizobium, is recommended as a precautionary measure.

What crop yield and quality effects can I expect, that I should manage for?

About half of the farmers interviewed from the Lower Eyre Peninsula fire considered that they experienced no crop yield or grain quality changes in burnt paddocks. Others reported visual crop differences and one measured a 20-25% yield depression in the second year after the fire. Yield reductions appeared to be confined to lighter soil types that had suffered topsoil loss through wind erosion following the fire.

A common sentiment was that crops were showing signs of N deficiency more readily than the farmers would normally expect, and that the loss of organic matter from the soil surface and in the topsoil made it more difficult to maintain a steady feed of N to the crop in line with demand. Several considered that their crops on burnt land were still not performing as well as they should in 2007, the third season after the fire. N and trace elements (copper and zinc) were considered to be the missing ingredients.

Western Australian results put crop yield losses in the year after a fire up to as high as 30%. Up to 5 mm of soil loss was difficult to see in the paddock, but 8 mm of topsoil loss from a pasture paddock caused a 20% yield drop in the subsequent crop. A similar yield depression was recorded for 25 mm of topsoil loss from a crop paddock.

Soil testing for nutrient analysis (N, P, K, organic C) is recommended, especially on paddocks that suffered significant topsoil loss after the fire. This should be done in autumn, so that test results are available to guide fertiliser decisions for sowing. Regular monitoring of crops on burnt paddocks for nutrient deficiency symptoms, particularly N and trace elements, is also advised.

Where N deficiency is anticipated or diagnosed, several applications through the growing season may provide better N use efficiency than a single seeding application, especially on canola and higher yielding cereal crops.

What are the important issues for livestock management after the fire?

Early assessment and treatment of livestock after the fire is essential, as outlined previously. Dispose of injured stock as a priority, especially any whose productivity is likely to be impaired as a result of burns or other effects of the fire.

A decision then has to be made on management of healthy livestock – retain on farm or move off farm? A key factor in this will be the extent of fire damage across the farm, and the availability of options such as agistment or feed reserves for handfeeding.

Many farmers on the Lower Eyre Peninsula (where whole farms were burnt out right across the district) reported that it was a great advantage to remove all livestock from the farm for a number of months. This allowed them to concentrate their efforts on planning and rebuilding the farm infrastructure and enabled paddocks to regain good protective cover. It was also important that stock were not returned too soon, to ensure that pastures and soil cover were fully recovered. The absence of livestock also allowed more intensive cropping in the year following the fire, as a strategy to generate cash flow more quickly.

On the downside, lack of sufficient stock to adequately graze recovering paddocks allowed invading weeds such as Salvation Jane and wild radish to gain a foothold.

Where livestock are to be returned to paddock grazing as soon as pastures are well enough established to provide adequate soil cover, replacing damaged fences should be a high priority to ensure effective grazing management.

If stock are to be kept on-farm with supplementary or full hand-feeding, the situation will be similar to drought feeding and management. Relevant information on handfeeding is available in the Western Australia Department of Agriculture Bulletin 4651 **Feeding and managing sheep in dry times** (Reference 8) or **Feeding beef cattle**, Bulletin 24/74/96 from Primary Industries SA (Reference 9). The PIRSA website is another source of livestock feeding and management information: www.pir.sa.gov.au/pirsa/nrm/drought/livestock_management_and_feeding/ .

Livestock should be treated for internal and external parasites before being sent off to agistment.

When bringing stock onto the farm, either returning from agistment or purchased, it is advisable to handfeed them in a confined area or feedlot for at least 2 weeks to minimise the risk of introducing new weeds onto the farm. Further information on this aspect is given in **Weed strategies following drought, fire and flood**, NSW Department of Primary Industries Primefact 372 (Reference 10).

An unexpected bonus for one farmer on Lower Eyre Peninsula was that the fire burnt sheep dung in paddocks and thus greatly reduced the worm problem on his farm. He has since been able to prevent re-infestation.

Are there any other potentially beneficial effects of the fire that I can capitalise on?

Depending on the extent of damage to farm infrastructure, a major fire may provide an opportunity for farmers to revisit their property plan and implement changes. Many farmers recognised this as a silver lining to the Lower Eyre Peninsula fire.

Elements of the farm plan that should be reviewed include:

- The physical layout of internal farm fences and raceways, to form paddocks of more uniform soil type and thus facilitate farming to land capability, improve livestock management and movement, and protect areas of native vegetation.
- Identification of areas best suited to perennial or permanent pasture or fodder establishment, such as lucerne, perennial ryegrass, or saltbush.
- The farm enterprise mix – the balance of cropping and livestock enterprises to meet personal and financial goals.

Rebuilding of fences and farm facilities such as shearing sheds and chemical storage sheds can provide an opportunity to incorporate improvements in location, design and construction materials, e.g. to make fences more fire-proof.

But such a review needs time and a clear head. Farmers should not feel pressured to get the farm infrastructure fully restored and the farm back into full production overnight. Removal of livestock from the farm was acknowledged by a number of Lower Eyre Peninsula farmers as a key factor in allowing them the breathing space to focus on such a review and implement changes only after adequate consideration.

A final comment

Much can be gained to restore confidence by talking to other farmers who have previously been through a fire and farm recovery experience. Further to this, the opportunity to meet and share experiences and ideas with others in the same predicament should be an essential component of the recovery process.

References and Further Reading

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State Agriculture/Primary Industries agency bushfire and related information webpages

- www.dpi.nsw.gov.au/agriculture/emergency/bushfire/
- www.farmpoint.tas.gov.au/farmpoint.nsf/Drought,-Bushfires-&-Emergencies/
- www.pir.sa.gov.au/pirsa/emergency_management/
- www.pir.sa.gov.au/pirsa/nrm/drought/livestock_management_and_feeding/

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Appendix

Measuring and monitoring fire effects on agricultural land. Final Report on the "Fire impacts study on Lower Eyre Peninsula" project for the Lower Eyre Peninsula Bushfire Re-establishment Program, compiled by Jim Egan, SARDI. (September 2006).