FOREST OPERATIONS AROUND SINKHOLES

Earth Sciences guidelines provide information for Forest Practices Officers on soil, water and geoscience issues in production forests. These guidelines are advisory and should be read in conjunction with the requirements of the Forest Practices Code.

PD McIntosh, Forest Practices Authority, Hobart

BACKGROUND

Sinkhole, Railton, Tasmania, 2011

Sinkhole, Iran (Khanlari et al. 2010)

Sinkholes in limestone or dolomite terrain can collapse rapidly, as shown by the above examples from Tasmania and overseas. Despite the risks, land with soils underlain by limestone and dolomite is used for primary production in Tasmania, and risks must be managed. Kiernan (2002) classified sinkholes, described sinkhole formation processes and described landscape risks but did not present clear management guidelines. To help manage risks associated with sinkholes in forested terrain sinkholes have been pragmatically reclassified as **active**, **passive** and **recent**. (The term passive does not imply that process of sinkhole formation has stopped, only that sinkhole formation processes have not been fast enough to be expressed markedly in the surface soil layer.) If the sinkhole contains a cave entrance the FPA must be informed – different management guidelines may apply.

TYPES OF SINKHOLES

Active sinkholes show one or more signs of present-day movement, e.g.:

- bare soil exposed in places (but generally vegetated)
- steep (>19^{o}) sides around most of the sinkhole; some faces may be vertical.

Active sinkhole about 5 m deep in alluvium over limestone, Florentine Valley, Tasmania

Passive sinkholes are closed depressions that do not show signs of present-day movement as defined above. The slopes within the sinkhole are mostly less than 19^{o}.

Passive sinkhole about 1 m deep in alluvium over limestone, Florentine Valley, Tasmania

Recent sinkholes have formed, or show visible signs of rapid reactivation, in the last ten years. They have features like vertical or overhanging sides and extensive exposure of bare soil or sediments. See McIntosh and Gibson (2013) for examples.

Recent sinkholes in alluvium over limestone, Railton, Tasmania

DEFINING THE EDGE OF SINKHOLES

The edge of a sinkhole is where slopes change from flat or convex (outside the sinkhole) to concave (in the sinkhole).

MANAGING SINKHOLES

Plantation harvest next to sinkholes

Generally this will be done under the salvage provisions of the Forest Practices Code (2000, p. 49) and consultation with the FPA will be required. The following guidelines apply in most situations:

- For **active** sinkholes: tracked feller bunchers may approach to 5 m from the edge of sinkholes.
- For **passive** sinkholes: tracked feller bunchers may approach to the edge of sinkholes.
- For **recent** sinkholes: a 10 m machinery exclusion zone (MEZ) from the edge of the sinkhole will be the minimum prescription. Safety consideration may mean that a wider MEZ is required, especially if sinkhole margins are overhanging.
- Processing should occur at least 10 m from the edge of active and passive sinkholes, and 20 m from the edge of recent sinkholes.
- Landings should be at least 20 m from sinkhole edges.

Re-establishment of plantations around sinkholes

- For **passive** sinkholes: a 5 m streamside reserve (SSR) will be applied from the edge of sinkholes. Allow to revegetate.
- For **active** sinkholes: a 10 m SSR will be applied from the edge of sinkholes. Ensure native revegetation occurs: replant with native seedlings or spread native seed.
- Where **4 or more sinkholes** (active or passive) form an obvious line it should be assumed that a stream runs underground and a continuous 10 m SSR should normally be applied – seek advice from the FPA.
- For **recent** sinkholes: a SSR at least 20 m wide will be required; large sinkholes may require a wider SSR. Ensure native revegetation occurs: replant with native seedlings or spread native seed.

These minimum SSR widths also apply to the application of chemicals (herbicides, insecticides and fertilisers). Chemical application near sinkholes should be done by ground-based machinery or by hand.

Native forest harvest next to sinkholes

Consultation with the FPA will be required. The following guidelines apply in most situations:

- For isolated **passive** sinkholes in clearfell, burn and sow coupes: machines may approach to edge of sinkholes, but should not skew in their tracks. Trees may be harvested within sinkholes by reaching in, provided no significant soil disturbance occurs within the sinkhole. Fire need not be kept out of the sinkhole area.
- For groups of **passive** sinkholes (e.g. four or more per hectare) apply a SSR with a buffer of at least 10 m from the edge of the outermost sinkholes.
- For **passive** sinkholes in aggregated retention coupes or selective harvest coupes: a 5 m SSR will be applied from the edge of sinkholes.

- For **active** sinkholes: apply a 10 m SSR from the sinkhole edge and protect from fire.
- Where **4 or more sinkholes** (active or passive) form an obvious line it should be assumed that a stream runs underground and a continuous 10 m SSR should normally be applied – seek advice from the FPA.
- For **recent** sinkholes a minimum 20 m SSR is required.
- Landings should be at least 20 m from sinkhole edges.

Should all depressions in karst terrain by classified as sinkholes?

Shallow and small-diameter sinkholes may be indistinguishable from depressions formed by windthrow or machine disturbance (e.g. earlier cultivation). The following recommendation applies:

- In karst terrain small depressions, up to about 3 m wide and about 0.5 m deep, need not be classified as sinkholes unless they show signs of recent activity (e.g. steep sides or soil exposure) or are clearly in line with defined sinkholes. They do not require marking in the field; normal harvest and planting can occur in and around and such features, but where they are detected during operations, they should be avoided by machines where possible.

Still unsure?

Contact the FPA.

REFERENCES

Forest Practices Authority 2000, *Forest Practices Code*, Forest Practices Authority, Hobart, 120 p.

Kiernan, K 2002, *Forest Sinkhole Manual*, Forest Practices Authority, Hobart. See also: *http://www.fpa.tas.gov.au/__data/assets/pdf_file/0008/58076/Forest_sinkhole_manual.pdf*

Khanlari, G; Heidari, M; Momeni, AA; Ahmadi, M; Berydokhti, AT 2012, 'The effect of groundwater overexploitation on land subsidence and sinkhole occurrences, western Iran', *Quarterly Journal of Engineering Geology and Hydrogeology* 45: 447–456.

McIntosh, PD; Gibson, N 2013, 'That sinking feeling', *Forest Practices News* 11(4): 19–20. http://www.fpa.tas.gov.au/__data/assets/pdf_file/0010/87733/FPN_vol_11_no_4_May_2013.pdf

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