Rapid damage assessment and grapevine recovery after fire

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Background

- In December 2019, a bushfire occurred in the Adelaide Hills, South Australia.
- 25,000 hectares were burnt and in vineyards and surrounding areas various degrees of scorching and infrastructure damage occurred.
- Current practice for measuring the scale and distribution of fire damage is to walk or drive the vineyard and score individual vines based on visual observation.
- However, the ability to coordinate and plan recovery after a fire event relies on robust and timely data.
- This study compared the rapid assessment and mapping of fire damage using high-resolution satellite imagery with more traditional ground-based measures and assessed vine recovery.

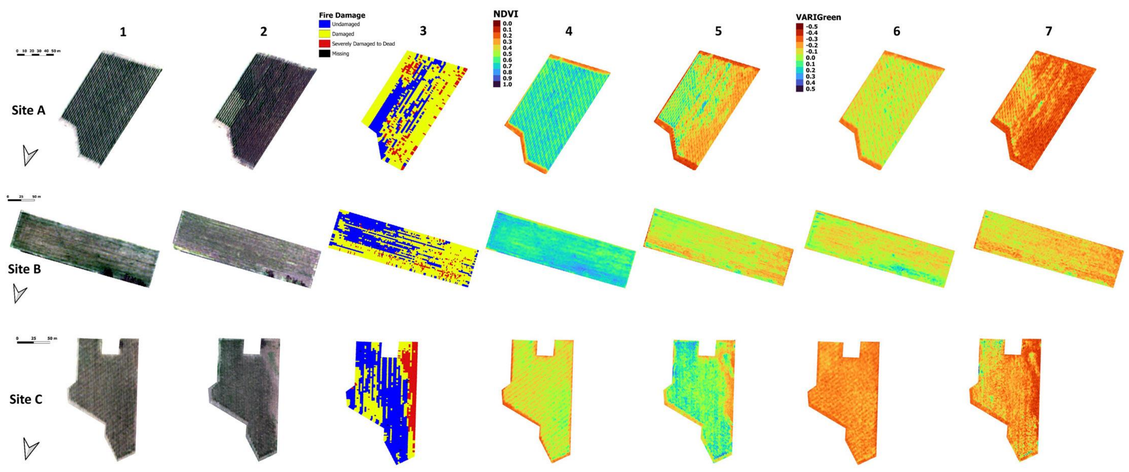

Figure 1. **Pre- and post- fire satellite imagery (1,2), ground truth sampling raster (3), pre- and post- fire Normalised Difference Vegetation Index (NDVI) imagery (4,5) and Visible Atmospherically Resistant Index Green (VARIgreen) imagery (6,7) of sites A, B and C, Adelaide Hills, South Australia. The ground truthing colours are red, yellow and blue to indicate severe, minor-moderate damage and no visible damage; black indicates missing vines (Collins et al. 2022)**

Methods

- Ten sites in the Adelaide Hills were assessed for initial fire damage and monitored for recovery two years post bushfire event (Sites A, B and C are shown as examples in figures).
- Pre- and post- fire satellite imagery, ground truth sampling raster, NDVI and VARIgreen imagery were captured from fire damaged sites (Figure 1).
- Canopy growth, vine fertility and starch concentrations were tracked in the two seasons post-fire to assess vine recovery.

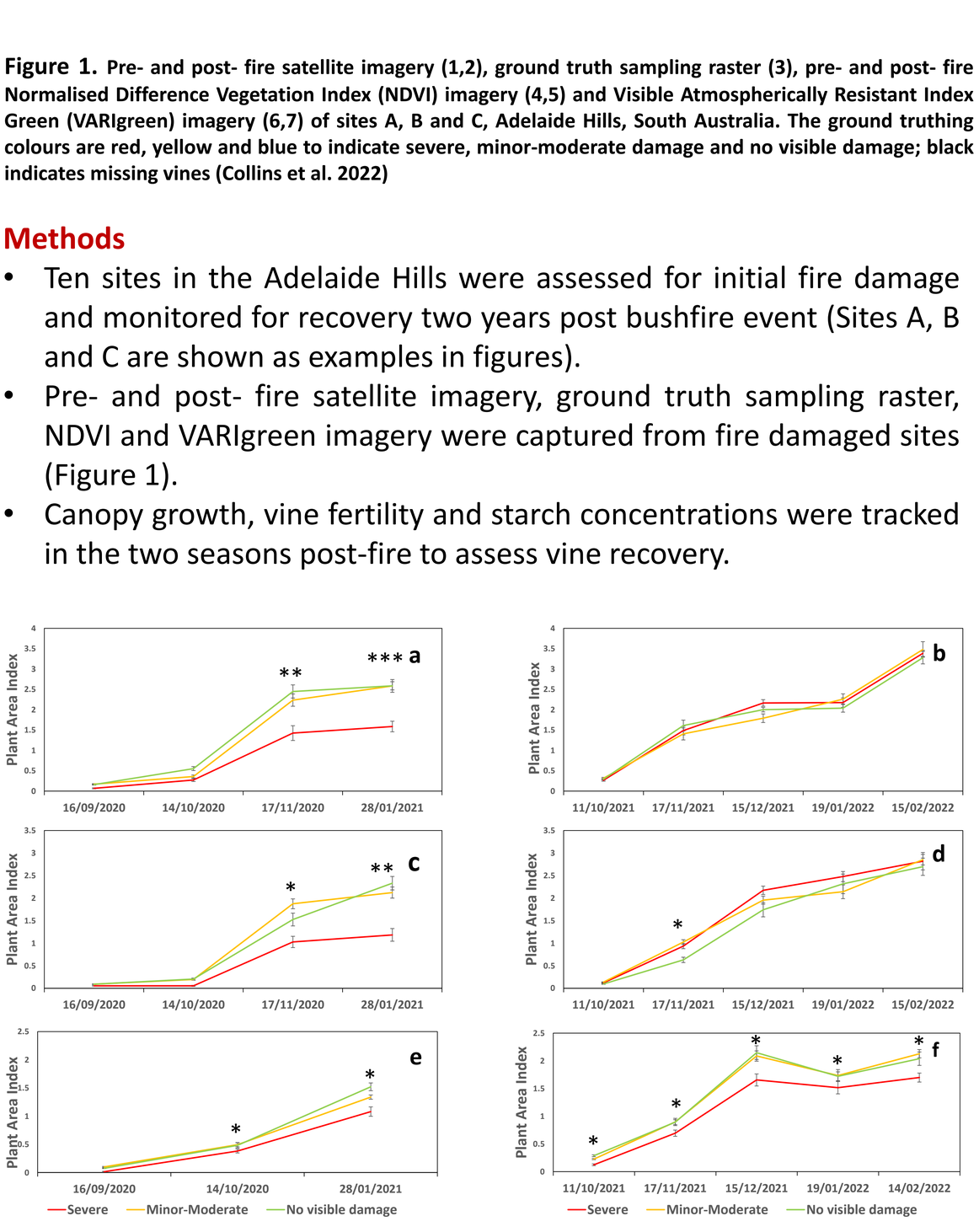

Figure 2. Plant Area Index measures of three different fire damage classifications; severe, minor-moderate and no visible damage at sites A (a and b), B (c and d), and C (e and f) from the 2020/21 and 2021/22 growing seasons, Adelaide Hills, South Australia. Fire damage classifications were analysed using one-way ANOVA. Each data point is a mean of n = 12 vines. Bars indicate the standard error. *, ** and * indicate significance at p ≤ 0.05, 0.01 and 0.0001 respectively, using the LSD test at 5 % level. (Collins et al. 2022)**

Results

- Correlations between ground visual fire damage assessments and postfire NDVI (-0.347 to -0.084) and VARIgreen (-0.333 to 0.074) satellite imagery were significant but showed no correlation to a weak negative correlation.
- Fire damaged vines had reduced canopy growth, had low fertility or in some cases were infertile and lower bud and cane starch concentrations (data not shown), which reduced productivity in the seasons following the bushfire event (Figures 2 and 3).
- In most cases, vines that received minor-moderate damage were able to recover within 1-2 years.

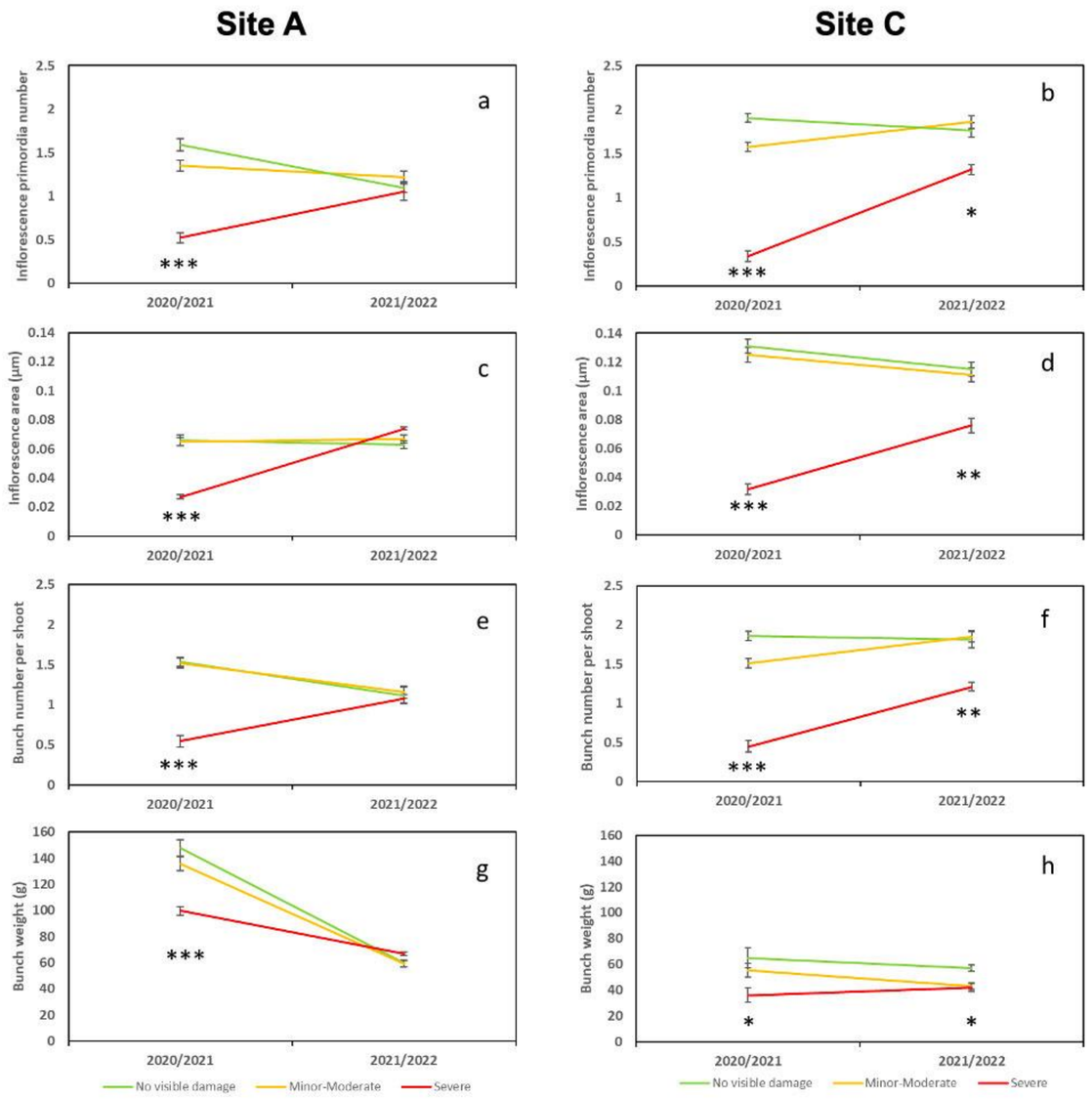

Figure 3. **Inflorescence primordia number (a and b), inflorescence area (c and d), bunch number per shoot (e and f) and bunch weight (g and h) measures of three different fire damage classifications; severe, minor-moderate and no visible damage at Sites A and C in the 2020/21 and 2021/22 growing seasons Adelaide Hills, South Australia. Fire damage classifications were analysed using one-way ANOVA. Each data point is a mean of n = 12 vines. Bars indicate the standard error. *, ** and *** indicate significance at p ≤ 0.05, 0.01 and 0.0001 respectively, using the LSD test at 5 % level. (Collins et al. 2022)**

Conclusion

Large differences in canopy growth and reproductive development between the different levels of fire damage are believed to be of value and interest to producers and managers as they provide some insights into the recovery process that can be used for vineyard management decision making. Tools that rapidly and affordably capture the extent and severity of damage over large vineyard area will allow producers, government and industry bodies to manage decisions in relation to fire recovery planning, coordination and delivery, improving the efficiency and effectiveness of their response.

Reference

Collins, C., Ritchie, M., James, A., O'Brien, P., Ma, S., De Bei, R., Clarke, A. (2022) Grapevine recovery after fire and a first look at rapid damage assessment with satellite imagery. OENO One, *in press*

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