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Management of invertebrate pests in forests of south-west Western Australia

Ecosystem Science

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Management of invertebrate pests in forests of south-west Western Australia

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Context

Within the history of forest and natural landscape management in Western Australia, many invertebrates are known to utilise forest biomass for their survival and in doing so impart some form of damage to leaves, shoot, roots, stems or branches. There are 10 recognised invertebrate species with demonstrated significant impact on tree health, vitality and timber quality within our natural environment. Currently the most prevalent insect pests of concern in native forests are *Perthida glyphopa* (jarrah leafminer, JLM), *Phoracantha acanthocera* (bullseye borer, formerly known as *Tryphocaria acanthocera* BEB) and *Uraba lugens* (gumleaf skeletoniser, GLS). Both JLM and GLS have documented population outbreak periods, and BEB incidence appears to be responsive to drought stress and is likely to increase. However, Western Australian forests and woodlands also have a history of developing unexpected insect outbreaks with dramatic consequences for the ecosystem health and vitality. The decline in mean annual rainfall in south-west Western Australia since the 1970s and global climate model predictions of a warmer and drier environment mean conditions for invertebrate pests will alter significantly in the next decade as our environment shifts toward a new climatic regime. This project addresses both recognised and emerging/potential invertebrate forest pests, and is designed to augment forest health surveillance and management requirements by providing knowledge on the biological aspects of forest health threats from invertebrates in the south-west of Western Australia.

Aims

- Investigate aspects of pest organism biology, host requirements, pathology and environmental conditions (including climatic conditions) that influence populations.
- Determine distribution of the invertebrate pests, including outbreak boundaries and advancing outbreak fronts, using aerial mapping, remote sensing and road surveys.
- Measure relative abundance of invertebrate pests, including quantitative population surveys and host/environmental impact studies where appropriate and/or possible.
- Utilise appropriate monitoring technologies including GIS and remote sensing.
- Liaise with land managers and the community regarding responses to pest insect outbreaks.

Progress

- Pheromone trapping of GLS was used to quantify the 2015/16 GLS population level. Populations capable of moderate to severe defoliation were present in areas around Donnelly Mill north west of Manjimup.
- A paper investigating climate effects on GLS outbreaks was prepared and submitted to *Austral Entomology* and is currently being revised after referee comments.
- A preliminary study was initiated investigating effects of understorey removal by fire on pheromone trap catch. Catch data have been summarized and analyzed. Dense understorey interferes with pheromone trap effectiveness. Fire enhances trap catch in forest with a dense understorey by removing the shrub layer. Testing for a vegetation effect using a dryness index as a proxy for vegetation density showed negligible impact on the historical data from long term GLS population monitoring sites.

Management implications

- Integration of GLS population and impact data from two major outbreak events indicates a strong relationship between GLS outbreak and periods of below-normal rainfall at seasonal or longer timescales. Further outbreaks are likely given present declining trends in rainfall.

- Pheromone trapping is effective in monitoring GLS populations and could be used routinely to identify the likelihood of GLS outbreak. Moth populations are a good predictor of subsequent larval populations and may provide early warning of outbreak events in the context of climate data.
- Interference with pheromone based mate finding by vegetation has implications for moth species richness at landscape scales because pheromone based mate finding is common in moths (including other eucalypt defoliators). Understanding drivers of moth richness may allow spatial predictions of moth species richness and enhance understanding of effects of global change on moth biodiversity.
- Vegetation density and structure as well as species composition and fire regimes in jarrah forest has implications for rate of spread and control of potentially invasive and exotic moth species which use pheromone based mate finding.

Future directions

- Continue pheromone trapping at long-term monitoring sites.
- Prepare a manuscript describing fire and vegetation density effects on the efficacy of GLS pheromone trap catches.
- Investigate vegetation species composition and fire effects at different trap heights using the GLS pheromone system.
- Finalize edits and publish paper describing relationship between long term GLS population and climate cycles.