Wasmannia auropunctata (electric ant)
Draft Initial Economic Impact Assessment

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Introduction

The objective of this assessment is to provide information on the economic significance of the introduced *Wasmannia auropunctata* (electric ant, or little fire ant) in Australia, for input into the decision on eradication of the colony established in the locality of Smithfield. The short name of *Wasmannia* is used in this report for the ant in question.

This report uses initial information on likely *Wasmannia* dispersion provided by Joe Scanlan.

Method

The economic impact assessment uses as its inputs quantitative indicators of:

- the impact of the pest in specific environments and on specific components of the human value system,
- the expected dispersal from the initial infestation over the timeframe of the analysis, and
- the costs and likely impacts of alternative control strategies.

The report provides:

- indicative discounted cash flows of impact associated with alternative scenarios (eg, attempted eradication vs management without eradication),
- a first assessment of the incremental value of the eradication option, and
- information about the expected payoff of the eradication option (measured as returns on the funds to be used for eradication).

Kompas and Che (2001) is the most relevant example of such a full impact analysis, as it was carried out on the planned eradication of the red imported fire ant (RIFA) in Queensland. This assessment uses a similar method, adapted to the specific situation.

Dispersal of *Wasmannia*

Initial modelling of the dispersal (Joe Scanlan, pers. comm.) indicates a radial dispersion from Smithfield in an inkblot pattern where smaller blots advance in front of the solidifying main front. Most importantly from the point of this analysis, major impact on Cairns is observable from year 10, and by year 20 all of the city is affected.

This dispersal model does not address the probability of human-assisted dispersal to greater distances. Due to their close proximity to humans and having multiple queens, *Wasmannia* are well suited to human dispersal. It is quite conceivable that, in the absence of eradication, *Wasmannia* may be carried to major population centres or further into other areas of the Wet Tropics World Heritage Area (WTWHA).

Alternative response scenarios

Response options to the *Wasmannia* infestation are:

- *Eradication* – current budget of $6.8m spread over four years, with a larger initial component.
- *Containment* – similar to the year-one eradication cost, but subsequent years' cost are around one-fifteenth of eradication.
- *Management* – provision of public information only, annual cost to government is negligible.

As recommended by FAO (1998), impacts of the dispersal of *Wasmannia* in this report are considered against the 'management' alternative, that is, in the absence of a central, coordinated attempt at eradication or containment. It is assumed that any isolated alternative measures taken by individuals will not hinder the natural dispersal of the ants, and neither will it prevent the establishment of satellite colonies through human-assisted infestations.

Economic impacts and costs under 'management'

In terms of their effect on socio-economic functions, different impacts of *Wasmannia* can be predicted on:

- Residential areas
- Agricultural areas
- Natural ecosystems
- Tourism

Residential-area impacts

Unlike RIFA, *Wasmannia* move into buildings to nest and forage. Thus coming in contact with people and property, *Wasmannia* have a larger impact on residential areas than RIFA.

Kompas and Che (2001) quoted sting rates of 10-33 per 1000 of population for RIFA in the US. Even though *Wasmannia* do not sting as readily and in groups as RIFA, it is encountered in homes unlike RIFA. Hence, it is reasonable to expect similar overall sting rates across the human population for *Wasmannia*, and similar rates of home medication to ease symptoms. Inquiry at Queensland Health revealed the lack of data that would allow the separation of the effects of individual insect species. While insect stings constitute an acknowledged cause of medical cases, in most cases it is not possible even to identify the insect responsible. For the purposes of this study, it is assumed that medical expenses can be avoided by the individual treatment of residences, backyards, public buildings and public areas.

As in Section 6.1, RIFA sting rates are likely to be a reasonable approximation of those for *Wasmannia*, and a similar rate of casual absences from work may also be applicable. Similarly, it is also assumed that all such expenses are avoided by taking individual control measures in the absence of eradication, both in domestic and work environments.

Wasmannia keenly seek out foods containing fats in houses. The extent of food loss through ant infestation could not be ascertained, but it is assumed to be avoided by using ant individual control in the absence of eradication.

There has been anecdotal information about *Wasmannia* damage to electrical switches and appliances in Smithfield by clogging up electrical contacts (Tom McGraw, pers. comm.). Domestic ant control is assumed to help to avoid such damage.

Even if engaged in ongoing pest control, owners of properties in infested areas may suffer a reduction in their net assets through a decline in property values. An annuity value of such losses can be calculated to represent this effect, although initial consultation with Cairns real-estate agents does not indicate its presence (Kim Erbacher, pers. comm.).

Blindness and early deaths of domestic pets have been documented in the literature. The presence of *Wasmannia* in dwellings makes the stinging of domestic pets likely, resulting in veterinary expenses and the financial costs of prematurely replacing pets. Interviews with veterinary surgeons in Smithfield revealed an approximate treatment cost for insect stings of $150-400 in cases without complications inside and outside business hours. One of two veterinarians reported a likely case of *Wasmannia* sting, however insect stings are generally undistinguishable by species. The extent of impact on pets may well be potentially substantial, given that there are 16,000 registered dogs in Cairns. Other pets need no registration, hence they lack similar statistics. Nevertheless, it is assumed in this analysis that the treatment of houses and backyards would help to avoid impact on pets.

Living with *Wasmannia* would impose hardship beyond the measurable economic loss and mitigation costs. It is implicit in the partial control costs assumed in this study that the part of the population not willing to pay to control *Wasmannia* will change their lifestyle by, eg, avoiding their backyards altogether. This reduction in their quality of life will be equivalent to an amount significantly less than the relevant control cost.

Pest control in residential areas

For the purposes of this analysis it is assumed that all impacts in residential areas can be avoided by the individual properties' owners by regular ongoing pest control.

Continuous baiting is required for effective control in houses in infested areas. Annual control cost was quoted by two different contractors at $77 and $165 for Smithfield houses: the average value of $120 was used in the analysis. The single quote for treating a standard Smithfield house plot was $315.

There are 247 residential properties in the currently infested area, and, assuming four people to a residence, there may be around 31,000 residential dwellings in the Cairns region. It is also assumed that the number of business premises and public buildings amount to 5% of private dwellings. Pest control for larger buildings such as schools or hospitals would be expected to cost more in proportion to their size relative to houses: a 5-times multiplier was used in this study. It is assumed that all business premises and public buildings would be regularly treated against *Wasmannia*, but the proportion of houses and house plots treated would be, respectively, 80% and 50% in Smithfield and decline to 60% and 30% for the whole of Cairns.

The dispersion model supplied information on the residential areas impacted in specific years. Missing years' figures were generated by linear interpolation. It was assumed that the land area is 1000 m^2 per residence. Table 1 summarises the assumptions about the spread and treatment cost of *Wasmannia* in residential areas in and around Cairns.

Table 1 *Expected Wasmannia treatment costs over time in residential areas*

Year	Houses impacted	Houses treated	House treatment costs	Bus&publ treatment costs	Residential land impacted*	Residential land treated	Res land treatment costs
		%	$	$	ha	ha	$
1	100	80%	9640	3013	**117**	50%	184275
2	174	80%	16725	5227	**163**	50%	256725
3	247	80%	23811	7441	191	50%	300300
4	329	80%	31690	9903	218	50%	343875
5	410	80%	39568	12365	**246**	50%	387450
6	492	80%	47447	14827	271	50%	426038
7	574	80%	55326	17289	**295**	50%	464625
8	656	80%	63205	19751	326	50%	513450
9	737	80%	71084	22214	357	50%	562275
10	819	80%	78962	24676	**388**	50%	611100
11	3837	79%	365282	115596	760	49%	1172288
12	6855	78%	644329	206516	**1131**	48%	1710072
13	9873	77%	916101	297436	1465	47%	2168439
14	12891	76%	1180601	388355	1798	46%	2605785
15	15910	75%	1437826	479275	**2132**	45%	3022110
16	18928	74%	1687778	570195	2797	44%	3876642
17	21946	73%	1930456	661115	3462	43%	4689279
18	24964	72%	2165861	752035	4127	42%	5460021
19	27982	71%	2393992	842955	4792	41%	6188868
20	31000	70%	2614850	933875	**5457**	40%	6875820
21	31400	69%	2610753	945925	6122	39%	7520877
22	31800	68%	2605692	957975	6787	38%	8124039
23	32200	67%	2599667	970025	7452	37%	8685306
24	32600	66%	2592678	982075	8117	36%	9204678
25	33000	65%	2584725	994125	8782	35%	9682155
26	33400	64%	2575808	1006175	9447	34%	10117737
27	33800	63%	2565927	1018225	10112	33%	10511424
28	34200	62%	2555082	1030275	10777	32%	10863216
29	34600	61%	2543273	1042325	11442	31%	11173113
30	35000	60%	2530500	1054375	**12107**	30%	11441115

* Source for numbers in bold: dispersal model (Joe Scanlan, pers. comm.), others are interpolated

It must be pointed out, however, that controlling *Wasmannia* on individual properties amounts to symptomatic treatment only. Since points of infestation remain, there is a continuous source of incursion into pest-controlled areas.

Lost agricultural production

Wasmannia cause direct physical damage to plants by destructively feeding on nectar-bearing organs. This is likely to compromise fruit formation by the attacked orchards or vegetable crops. However, currently no information exists about the extent of such damage.

Indirect damage is caused to plants by *Wasmannia*'s protecting of sap-sucking insects. Such infestations result in lost production through reduced plant vigour and opportunistic diseases (sooty-mould infections have been documented). In addition to the opportunity cost of lost production, direct production costs are increased by the additional insecticide and fungicide treatment required..

Wasmannia infestation has forced a change in production practices on a cane field near Smithfield. The farmer had to return to burnt harvesting his cane, causing:

- a 0.5 reduction in CCS (sugar content) worth around $200/ha for the industry, and
- the need to carry out additional weed control at an approximate cost of $80/ha.

Another indirect impact on production is through *Wasmannia's* stinging of agricultural workers that is said to have caused substantial losses in New Caledonia (Jane Royer, pers. comm.). Fruit trees and vegetables constitute types of crops where direct bodily contact between plants and humans is essential. There is no substitute for manual harvesting for bananas, most fruit trees and most vegetables. Seasonal labour for fruit and vegetable picking is already in short supply in Queensland, and being stung by *Wasmannia* will further discourage worker recruitment. Consequently, farmers will either have to pay pickers much more for the discomfort and also use control measures, or see their crop remaining at least partly unharvested. Tree pruning will also become an unpleasant activity, and its neglect will compromise productive capacity.

Wasmannia venom affects health in general and eyesight through cornea damage in particular. It is expected that some farm animals may die prematurely if stung, a problem particularly for the dairy industry. In addition, milk production by stung dairy cows may also be affected.

Major agricultural areas of Queensland are in the relative vicinity of Smithfield. Significant fruitgrowing regions are along the wet tropical coast within 200 km south of Cairns, including the banana industry around Tully that is Australia's largest. The Atherton Tablelands, some 50 km west, is an area with various tree (avocados, mangos, coffee, tea) and vegetable crops. It is also the centre of the north-Queensland dairy industry. Table 2 summarises the gross values of production (GVP) of, and employment (in full-time equivalents or FTA) by, these industries.

Table 2 *Agricultural industries near Smithfield*

	Wet Tropics		Atherton Tablelands	
	GVP $m	employment FTA	GVP $m	employment FTA
Fruit	330	1983	77	409
Vegetables	3	51	25	265
Dairy cattle	0	0	33	370

Source: Qld DPI 2001 Queensland regional input-output tables

It is expected, that affected farmers will be forced to use regular control measures to prevent the above impacts. The expected cost of knock-down pesticide application in bananas before harvest has been estimated at $230/ha (Kim Erbacher, pers. comm.). It is assumed that the costs will be similar in other crops, and that 80% of affected area will be treated in any given year. Table 3 shows the areas of impacted agricultural land (interpolated from data provided by Joe Scanlan, pers. comm.) and the cost of annual treatment.

Table 3 *Expected Wasmannia impact on agriculture around Cairns*

Year	Dryland Agriculture ha	Irrigated Agriculture ha	Total area Affected ha	Treatment costs on 80% $
1				
2				
3				
4				
5	**1**		1	184
6	47		47	8685
7	93		93	17186
8	140		140	25686
9	186		186	34187
10	**232**	**8**	240	44160
11	464	79	543	99875
12	695	150	846	155590
13	927	222	1148	211306
14	1158	293	1451	267021
15	**1390**	**364**	1754	322736
16	1940	729	2669	491096
17	2490	1094	3584	659456
18	3041	1458	4499	827816
19	3591	1823	5414	996176
20	**4141**	**2188**	6329	1164536
21	5287	4056	9343	1719112
22	6432	5925	12357	2273688
23	7578	7793	15371	2828264
24	8723	9662	18385	3382840
25	**9869**	**11530**	21399	3937416
26	12442	14887	27329	5028610
27	15015	18244	33260	6119803
28	17589	21602	39190	7210997
29	20162	24959	45121	8302190
30	**22735**	**28316**	51051	9393384

[a] Source for numbers in bold: dispersal model (Joe Scanlan, pers. comm.), others are interpolated

Reduced ecosystem services

Wasmannia's impact on ecosystem function in affected areas can be severe, as up to 100% of native ants have been replaced in the Australian incursion area. Significant reductions in other native invertebrate and vertebrate species are also documented symptoms of *Wasmannia* incursions. As described in Section 3, the current infestation is bordering on the Wet Tropics World Heritage Area, and is close to significant local sites of the Area.

Indirect economic impact of *Wasmannia* through the reduction of ecosystem services in conservation areas is potentially the source of largest damage. Its quantification in economic terms, however, is nearly impossible owing to the complexity and unquantified nature of the processes involved..

The WTWHA contains a large number of endangered species, including eight frogs, six mammals and six birds. 20 vertebrate species and one invertebrate species have been declared vulnerable (WTMA 2006). Reports of *Wasmannia* impact elsewhere indicate that ground-dwelling animals are placed at particular danger. Hence, a

number of ecosystem goods and services provided by the WTWHA are threatened by *Wasmannia*: these are italicised in Table 4 by the author of this analysis.

Table 4 *Ecosystem goods and services provided by the WTWHA*

Environmental values and processes	Environmental regulation	Community services	Community enrichment
• *biodiversity*	• *habitats and refugia*	• *soil formation & fertility*	• conversion of solar energy
• biomass production	• pollination	• carbon sequestration	• nitrogen fixing
• water cycles	• *genetic resources*	• *nutrient recycling*	• regulation of regional & microclimates
• flood mitigation	• water purification	• fire regimes	• *pest control*
• groundwater recharge	• waste treatment	• erosion control	• food
• clean water supply	• energy (hydro, solar & wind)	• energy conversion	• soils
• pharmaceutical and biological products	• horticultural products	• shade and shelter	• *tourism*
• recreation and leisure activities	• *spiritual values and enjoyment*	• art and craft materials	• scenic & aesthetic values
• cultural and historical values	• awareness and education	• *natural values*	• sense of place and identity
• *maintaining options for the future*		• *scientific discovery*	

Source: WTMA (2006)

The Wet Tropics World Heritage Protection and Management Act 1993 (Queensland 2006) states that "Australia's obligation under the [World Heritage] convention is to ensure the protection, conservation, presentation, rehabilitation, and transmission to future generations, of the natural heritage of the [Wet Tropics World Heritage] area."

Australia is signatory to the World Heritage Convention. Article 5 of the Convention (UNESCO 1972) prescribes that: "To ensure that effective and active measures are taken for the protection, conservation and presentation of the cultural and natural heritage situated on its territory, each State Party to this Convention shall endeavor, in so far as possible, and as appropriate for each country:

...

(d) to take the appropriate legal, scientific, technical, administrative and financial measures necessary for the identification, protection, conservation, presentation and rehabilitation of this heritage"

Hence, it would appear that the Australian and Queensland governments are under legal obligation to prevent the impact of *Wasmannia* on the endangered species of the WTWHA. Realistically, this is only possible by a complete eradication.

Tourism impact

Wasmannia may also have a direct effect on tourism, if it were established in locations where its stings became a significant nuisance for visitors. There is also a relationship between impacts on tourism and agriculture. A portion of tourists to North Queensland are backpackers who support themselves by casual work in agriculture. If *Wasmannia* were to negatively impact on one of these sectors, the other would also be affected..

The estimated value of tourism to the WTWHA is around $700m per annum (WTMA 2006). Since the current infestation is next to the WTWHA, its spread into the area is

almost certain without eradication. The dispersal model (Joe Scanlan, pers. comm.) specifies the likely extent of infested conservation. Although some kind of impact on tourism in the WTWHA is likely, its extent is purely speculatively put at 2% of the economic value of tourism, pro rata to the area affected (Table 5).

Table 5 *Estimated tourism impact of Wasmannia*

Year	WTWHA area affected[a] ha	area affected %	Visitor numbers[b]	Yearly growth in visitors	Total value of tourism[c] $	Impact at 2% pro rata $
1						
2						
3						
4						
5	**942**	0.1%	**3430000**		**700000000**	14745
6	1538	0.2%	3544000	114000	723265306	24871
7	2134	0.2%	3658000	114000	746530612	35616
8	2729	0.3%	3772000	114000	769795918	46982
9	3325	0.4%	3886000	114000	793061224	58968
10	**3921**	0.4%	**4000000**	114000	816326531	71573
11	5661	0.6%	4110000	110000	838775510	106173
12	7401	0.8%	4220000	110000	861224490	142519
13	9140	1.0%	4330000	110000	883673469	180612
14	10880	1.2%	4440000	110000	906122449	220451
15	**12620**	1.4%	**4550000**	110000	928571429	262037
16	15837	1.8%	4650000	*100000*	948979592	336057
17	19054	2.1%	4750000	*100000*	969387755	413012
18	22270	2.5%	4850000	*100000*	989795918	492904
19	25487	2.8%	4950000	*100000*	1.01E+09	575731
20	**28704**	3.2%	5050000	*100000*	1.031E+09	661494
21	42606	4.8%	5140000	*90000*	1.049E+09	999361
22	56507	6.3%	5230000	*90000*	1.067E+09	1348646
23	70409	7.9%	5320000	*90000*	1.086E+09	1709350
24	84310	9.4%	5410000	*90000*	1.104E+09	2081473
25	**98212**	11.0%	5500000	*90000*	1.122E+09	2465016
26	107930	12.1%	5580000	*80000*	1.139E+09	2748319
27	117647	13.2%	5660000	*80000*	1.155E+09	3038718
28	127365	14.2%	5740000	*80000*	1.171E+09	3336213
29	137082	15.3%	5820000	*80000*	1.188E+09	3640802
30	**146800**	16.4%	5900000	*80000*	1.204E+09	3952487

[a] Source for numbers in bold: dispersal model (Joe Scanlan, pers. comm.), others are interpolated

[b,c] Source for numbers in bold: WTMA (2006), others are interpolated

Italicised numbers are the author's assumptions, all others are calculated

Economic benefits of *Wasmannia* eradication

The sum of potential *Wasmannia* impacts outlined in the preceding sections gives a net present value of $79m for the eradication option at a real discount rate of 5%. The benefit/cost ratio is 14:1, and the internal rate of return is 24%. These figures are on the conservative side, as no costs are attributed in this analysis for potential *Wasmannia* spread beyond areas highlighted in the dispersal model, in particular for possible introduction to major population centres. Thus, eradication can be

reasonably expected to yield a very substantial net social benefit and is in the social interest.

Conclusions

The documented economic impact of *Wasmannia* in infected areas is very significant. The range of habitats *Wasmannia* can live in is much broader than the best-known other invasive ant, RIFA, hence the former can be considered economically more threatening. While *Wasmannia* are naturally much less invasive than RIFA, their wider range of habitats, especially a propensity to nest in dwellings, makes them more prone for human-assisted dispersal than RIFA.

Costs of individually controlling *Wasmannia* in residential and agricultural areas have been estimated in this study. It is expected that all impacts in these areas are avoidable by taking individual control measures and, in turn, the benefit of eradication is the avoidance of individual control costs. The costs on tourism of *Wasmannia* spreading in in Wet Tropics World Heritage Area are calculated using the assumption of a 2% reduction in tourism values. On the basis of the avoidable costs across all assessed attributes, eradication appears to be in the social interest. Net economic benefits estimated have a net present value of $79m. Funds used in eradication would be returned fourteen-fold, yielding a 24% return.

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