Wet Tropics
Report Card 2018
Method for Assessing Invasive Weeds

Wet Tropics
Healthy Waterways Partnership

Developed by
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Acknowledgements

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Introduction

Invasive weeds are recognised to have a wide range of impacts on the ecosystems of the Wet Tropics and instream invasive weeds have major impacts on the health of the waterway environments. The impacts resulting from invasive weeds include: reduced abundance and diversity of native plant species; modification of habitat for native fauna species; blocking and choking of waterways; increased sedimentation and organic loading; decreased water quality; and hydrological modification. Programs designed to monitor and manage invasive weeds are conducted in all nine freshwater basins within the Wet Tropics Region through local governments and natural resource management groups and address priority species for management identified in Local Area Pest Management Plans or Biosecurity Plans. The monitoring programs provide regional scale mapping of invasive weeds that can be used to determine their distributions within waterway habitats. Members of the Wet Tropics Healthy Waterways Partnership Technical Working Group (TWG) have developed an indicator that reports on the annual monitoring data to provide a score for each freshwater basin based upon distribution and impact of invasive weeds of waterways.

Consideration was also made in regard to the transferability of the method and process to regions which do not have the underlying planning and reporting processes in place. It is anticipated that following initial data collation a joint mapping and prioritisation workshop with a regional expert panel would be adequate to emulate the process developed for the Wet Tropics.

Methods for Data Collection

An established pest and weeds planning and prioritisation process operates throughout Far North Queensland and includes all of the basins within the Wet Tropics region (FNQROC 2015). The process involves the collation of information by an expert panel composed of officers and stakeholders from the Local Government's Pest Working/Advisory Groups (PWGs). The process was used for identification of the species included in the invasive weed indicator, mapping the distribution of aquatic weed species and defining impact scores for each aquatic weed species. Each local government hosts a Pest Working Group or Advisory Committee. One of the primary roles of the group is to guide the development and delivery of the Local Area Pest Management/Biosecurity Plan. The group is comprised of the relevant stakeholders involved in pest and weed management but also by default includes and covers off on issues of water quality, catchment management, biodiversity and general NRM business. Members of local advisory groups typically include state land management agencies (National Parks, Natural Resources & Mines), Biosecurity Queensland, NRM groups, catchment groups, industry groups/representatives, conservation groups/representatives, landholders and elected representatives.

The Pest Working Groups/Advisory Committees are supported at a regional level by the Natural Asset Management Advisory Committee (NAMAC) facilitated by and reporting to the FNQ Regional Organisation of Councils (FNQROC). The membership of the NAMAC is

comprised of coordinator/manager level local government officers (natural areas management, pest management), NRM bodies and Biosecurity Queensland. The core membership of this group includes the local governments of Hinchinbrook, Cassowary Coast, Tablelands, Cairns, Mareeba, Douglas and Cooktown. Other members of the FNQROC within the Wet Tropics report card area including Yarrabah and Wujal Wujal are not currently included in the indicator.

Weed species that are distributed within Wet Tropics basins and which meet the following criteria were included in the invasive weeds indicator.

1. Priority species from Regional Pest Management Strategies or Local Government Biosecurity Plans.
2. Species with aquatic (in stream) habitat requirement and impact.
3. Able to be mapped (or are already mapped) at 1 kilometre grid resolution across the entire reporting region.
4. Management objectives, involving active management, in place across all jurisdictions.

Spatial analysis and assessments were conducted using ArcMap (10.0) and Community Viz (4.1.62.0). Spatial distribution data for each weed species is derived from a regional pest mapping project which has been in development and use in the Wet Tropics region since 2005. The mapping project underpins Local Governments statutory Pest/Biosecurity Management Plans. The grid mapping is updated in each revision of the Local Plans and generated from a combination of management/survey data intersected with a 1 km^2 grid to create a presence/absence field for each species. For analysis purposes the species are identified by the genus and species code method as outlined in the Queensland Spatial Pest Attribute Standard (SPAS) (Calvert 2012). Basin names and target species are captured in a single feature class and a short integer field (columns) is used to define presence [1] or absence [0] of each species in each grid cell (rows).

The distribution grid generated for each species is validated by local weed experts including members of the PWG from aerial imagery and local expert knowledge. Additional occurrences of weed species were added to the distribution grid as part of this process.

The weed distribution grid was intersected with the freshwater basin reporting zones to assign a basin name to each grid cell (partial grid cells were counted as whole grid cells if dissected by a basin boundary). The distribution grid for all species was then intersected with a single waterway habitat mapping layer compiled from dissolved polygons from Queensland Wetland Mapping representing lacustrine, palustrine, riparian and estuarine wetland types; and from Department of Natural Resources and Mines Queensland 1:100,000 ordered drainage network Stream order ≥3. For the purpose of creating a single polygon layer for the grid intersect, the stream order layer (polyline) was converted to a polygon by buffering (5 metres) and merging into a single feature. Both resultant polygons

were then merged into a single feature to create the spatial representation of waterway habitat. These procedures are presented in Figure 1.

As a component of the prioritisation process for the development of Local Area Biosecurity Plans each weed species was scored according to its impact upon waterways. Scoring is conducted by the PWG's for the impact of weed species on the aquatic ecosystem from low (1) to high (5) as per the scale provided in Table 1. For each species an average score was calculated from the scores assigned by the PWG's. This mean score provides the impact rating for the species for use in the indicator. A list of the aquatic species and their mean impact scores, Queensland and Australian legislative status, assessment profile links, and a summary of their impacts relating to waterways is provided in Appendix 1.

Table 1. Scoring scale for the impact of aquatic invasive weeds on aquatic ecosystems

 **Impacts on aquatic ecosystems (rivers, creeks wetlands and dams)**	**Impact score**
Potential to form solid stands of weeds or dense populations of pest animals. Likely to out-compete native species and impact on water quality/ water flow and creek and river ecosystem function. May limit access to creek banks and waterholes or damage infrastructure in dams. Chokes or disturbs waterways and wetlands. May stop or change how fish and birds use the area. Can lead to reduction of desirable plant and animal species, siltation and bank erosion. Pest animals impacts may transform aquatic habitats through significant disturbance, preying on native species or altering function of aquatic ecosystems	5
Will out-compete native species and impact on rivers, creeks and wetlands areas limited to area of the pest's suitable habitat. Might become a management issue in dam's water storages. Pest animals may disturb or degrade aquatic ecosystems but not significantly displace all native species.	4
Will occupy edges and disturbed areas and further degrade areas which are already under pressure or in poor condition. Limits the ability of plants and animals to establish and grow. Might require increased management in dams.	3
Will develop a presence in on rivers, creeks and wetlands areas without widespread effects on native species or significantly altering ecosystem function. Unlikely to result in reduction/modification of native vegetation. Might be present in dams but generally easy to manage if required	2

Unlikely to establish effectively in rivers, creeks and wetland areas unless by isolated dumping or escape from communities or town situations. Not adapted to succeed/survive annual flood events. Not a problem for dams. Pest animals not likely to reproduce or persist.	1

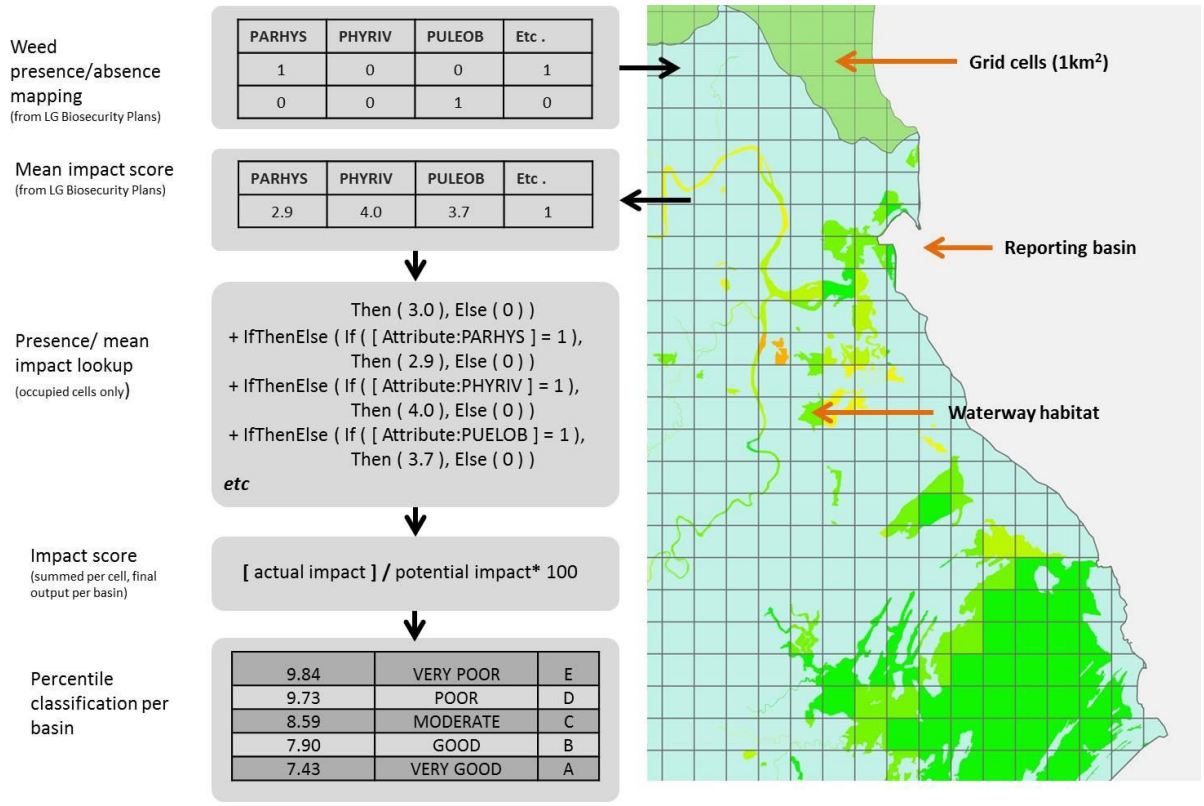

Figure 1. Key mapping and scoring procedures for the invasive weeds indicator.

Scoring Methods

The mapping procedure provided a record of the presence or absence of each weed species intersecting with the waterway habitat layer for all grid cells within each basin. The data was then exported from ArcMap into an Excel pivot table for processing. Key scoring procedures are presented in Figure 1.

Grid cells with at least one species of weed present were defined as occupied cells. The basin impact score was the sum of impact scores from all occupied cells within each basin. To determine the potential impact scores the assumption was made that all weeds identified in the prioritisation process would be able to potentially occupy each and every grid cell given their aquatic lifeform. The potential impact score for each basin was calculated as the sum of the impact scores for all weeds potentially present in all occupied grid cells (grid cells where at least one weed species occurred). In the pivot table the

potential impact score (the sum of all mean impact scores) and the actual impact score were calculated as a percentage per basin as follows.

Percent impact score = (actual impact score/potential impact score) x 100

The 10th, 25th, 50th and 75th percentiles of the percent impact scores from all basins were used to set the scoring ranges for each grade and formulae were applied to generate standardised scores for aggregation, as shown in Table 2.

Table 2 Scoring and grading for the invasive weeds indicator

Percentile range	Percent impact score	Grade	Standardisation formula for aggregation
0 - 0.10	0-13.35	Very good	Very good = (81.00 + ((19.00 - (score - 0.00) * (19.00 / 13.35))))
>0.10-0.25	>13.35-15.79	Good	Good = (61.00 + ((19.00 - ((score -13.35) * (19.00 / 2.44)))))
>0.25-0.50	>15.79-16.89	Moderate	Moderate = (41.00 + ((19.00 - ((score - 15.79) * (19.00 / 1.10)))))
>0.50-0.75	>16.89-19.72	Poor	Poor = (21.00 + ((19.00 - ((score - 16.89) * (19.00 / 2.83)))))
>0.75	>19.72	Very poor	Very poor = (20.00 - ((score - 19.72) * (20 / 80.28)))

Results

To demonstrate the results of the invasive weeds indicator the basin impact scores, potential impact scores and percent impact scores for each basin are provided in Table 3. The percent impact score, grade and standardised score for aggregation are provided in Table 4.

Table 3. Basin impact scores, potential impact scores and percent impact scores.

Basin	Basin impact score	Potential impact score	Percent impact score
Daintree	6,621.4	41,641.5	15.9
Mossman	1,054.3	5,904.1	17.9
Barron	7,113.8	43,518.3	16.4
Mulgrave	3,974.6	25,336.8	15.7
Russell	3,170.0	18,768.0	16. 9
Johnstone	7,470.6	39,999.3	18.7
Tully	5,853.1	43,831.1	13.4
Murray	4,983.1	24,007.4	20.8
Herbert	41,723.5	196,712.1	21.2

Table 4. Percent impact score, grade and standardised score for aggregation are provided

Basin	Percent impact score	Grade	Standardised score
Daintree	15.9	Moderate	58
Mossman	17.9	Poor	33
Barron	16.4	Moderate	50
Mulgrave	15.7	Good	61
Russell	16. 9	Moderate	41
Johnstone	18.7	Poor	28
Tully	13.4	Very Good	81
Murray	20.7	Very Poor	19
Herbert	21.2	Very Poor	19

Appendix 1. Wet Tropics Invasive Weeds Indicator: priority aquatic weeds, assessment profiles and waterway impacts

Scientific / common name / abbreviation*	**Mean Impact**	**State Legisl-ation**	**State Assessment Profile**	**National Legisl-ation***	**National Assessment Profile**	**Form and habitat**	**Waterway Impacts** Specific impacts are sourced from assessment profiles and general impacts, based upon form and habitat, are sourced from Arthington and Pearson (2007) and Ede and Hunt (2008)
Annona glabra / Pond apple / ANNGLA	4.8	Restri-cted	https://www.daf.qld.gov.au/__data/assets/pdf_file/0015/76002/IPA-Pond-Apple-PP58.pdf	WONS	https://www.daf.qld.gov.au/__data/assets/pdf_file/0004/56812/IPA-Pond-Apple-Nsplan.pdf https://www.environment.gov.au/biodiversity/invasive/weeds/publications/guidelines/wons/pubs/a-glabra.pdf	Aquatic/wetland tree; fresh and brackish environments	Instream and riparian habitat, hydrology, biodiversity, community composition, ecosystem process, water quality, aquatic food webs, Populations are capable of replacing whole ecosystems.
Hymenachne amplexicaulis/ Hymenachne / HYMAMP	4.8	Restri-cted	https://www.daf.qld.gov.au/__data/assets/pdf_file/0007/77092/IPA-Hymenachne-PP54.pdf	WONS	http://www.environment.gov.au/cgi-bin/biodiversity/invasive/weeds/weeddetails.pl?taxon_id=31754#	Ponded pasture. Aquatic Emergent	Instream and riparian habitat, instream connectivity, hydrology (restriction of flows and increased flooding), biodiversity, community composition, ecosystem processes, water quality, aquatic food webs,
Limnocharis flava / Limnocharis / LIMFLA	4.6	Restri-cted	https://www.daf.qld.gov.au/__data/assets/pdf_file/0017/125432/IPA-Limnocharis-PP141.pdf	National eradicati on target		Aquatic Emergent	Instream habitat, instream connectivity, hydrology (reduced flow velocity and increased sedimentation), biodiversity, community composition, ecosystem processes, water quality, aquatic food webs. Promotes disease vectors (e.g. mosquitoes).

Salvinia molesta / Salvinia / SALMOL	4.6	Restri-cted	https://www.daf.qld.gov.au/__data/assets/pdf_file/0003/65964/IPA-Salvinia-PP12.pdf	WONS	http://www.environment.gov.au/cgi-bin/biodiversity/invasive/weeds/weeddetails.pl?taxon_id=13665	Aquatic free floating	Instream habitat, hydrology (restriction of flow including flood flows), biodiversity, community composition, ecosystem processes, water quality, aquatic food webs. Promotes disease vectors (e.g. mosquitoes). Promotes water loss through transpiration.
Hygrophylla costata / Hygrophylla / HYGCOS	4.5	Restri-cted	https://www.daf.qld.gov.au/__data/assets/pdf_file/0016/62323/IPA-Glush-Weed-Risk-Assessment.pdf			Aquatic emergent	Instream habitat, hydrology (restricted flow), biodiversity, community composition, ecosystem processes, water quality, aquatic food webs.
Eichornia crassipes / Water hyacinth / EICCRA	4.3	Restri-cted	https://www.daf.qld.gov.au/__data/assets/pdf_file/0005/54680/IPA-Water-Hyacinth-PP6.pdf	WONS	http://www.environment.gov.au/cgi-bin/biodiversity/invasive/weeds/weeddetails.pl?taxon_id=13466#	Aquatic free floating	Instream habitat, hydrology (restriction of flows including flood flows), biodiversity, community composition, ecosystem processes, water quality, aquatic food webs. Promotes disease vectors (e.g. mosquitoes). Promotes water loss through transpiration.
Mayaca fluvatis / Bog moss / MAYFLU	4.2		https://www.daf.qld.gov.au/__data/assets/pdf_file/0008/54485/IPA-Bog-Moss-Risk-Assessment.pdf			Aquatic submerged, free floating	Instream habitat, hydrology (restriction of flow), instream connectivity, biodiversity, community composition, ecosystem processes, water quality, aquatic food webs.
Cabomba caroliniana / Cabomba / CABCAR	4	Restri-cted	https://www.daf.qld.gov.au/__data/assets/pdf_file/0005/72896/IPA-Cabomba-PP30.pdf	WONS	http://www.environment.gov.au/biodiversity/invasive/weeds/publications/guidelines/wons/pubs/c-caroliniana.pdf	Aquatic submerged attached or free floating	Instream habitat, hydrology (restriction of flow), biodiversity, community composition, ecosystem processes, water quality, aquatic food webs. Promotes disease vectors (e.g. mosquitoes).

Echinichloa polystachya / Aleman grass / ECHPOL	3.3	Restri-cted	https://www.daf.qld.gov.au/__data/assets/pdf_file/0003/68331/IPA-Aleman-Grass-PP137.pdf			Ponded pasture: aquatic emergent	Instream and riparian habitat, instream connectivity, hydrology (restriction of flows, biodiversity, community composition, ecosystem processes, water quality, aquatic food webs,

*WONS – weed of notational significance. *Name abbreviations were used for mapping and analysis purposes.

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