What weeds? Is the community really interested? Trials and tribulations of a weed mapping, data sharing and community engagement project in Far North Queensland

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Summary The Wet Tropics region of Australia is currently home to 28 vertebrate pests and over 500 naturalised plant species with an increase of approximately 200 of those over the past decade (Goosem 2007). Within these plant species, over 85 are identified as significant weeds (Werren 2004). The tropical climate and the demographic of invasives resulting from both agriculture and horticulture combine to create a high level of risk to the region's natural assets particularly through weed invasion. These favourable conditions for invasive species see many resources expended on management across all sectors. The collection of data on the distribution and status of pests can sometimes be a one-way transaction. Once submitted, contributors to mapping projects often never see their data again. One of the real challenges to engaging stakeholders in pest mapping is to ensure information can be returned to the contributor in a meaningful way with real utility. Stakeholders across Far North Queensland have been working towards a regional data sharing and mapping approach since 2005. This ongoing collaboration has led to the development of simple but effective data collection and display methodology based on a 1 km grid. The next stage of the project steps into the realm of web-based delivery and interaction and will enable not just stakeholders but the whole community to access, submit and display data in a generic internet based mapping environment. This paper discusses the progress of the project to date including the technology and principles behind the collection, the display of regional pest data and the partnerships that have built the project. Fundamentally, it also addresses the issue of community buy-in and engagement in pest management and asks the question: 'How does the future look and is an interactive web-based portal part of the answer?'

Keywords Mapping, data collection, community engagement, web portal.

INTRODUCTION

The Far North Queensland region covers a wide geographic area of north eastern Australia and takes in the transition from the Dry Tropics to the Wet Tropics, Gulf Savannah and Cape York Peninsula. The region has a monsoonal climate with wet, tropical summers and dry winters. Vegetation varies from open savannah, grassy woodlands and grasslands to tall wet forests and dense tropical rainforests.

Industry across the region is comprised of open rangeland grazing and cattle fattening through to intensive irrigated and non-irrigated cropping and tropical horticulture. Tourism forms a mainstay of the regional economy with Cape York Peninsula, and the World Heritage areas of the Wet Tropics and the Great Barrier Reef providing the key attractions to national and international visitors.

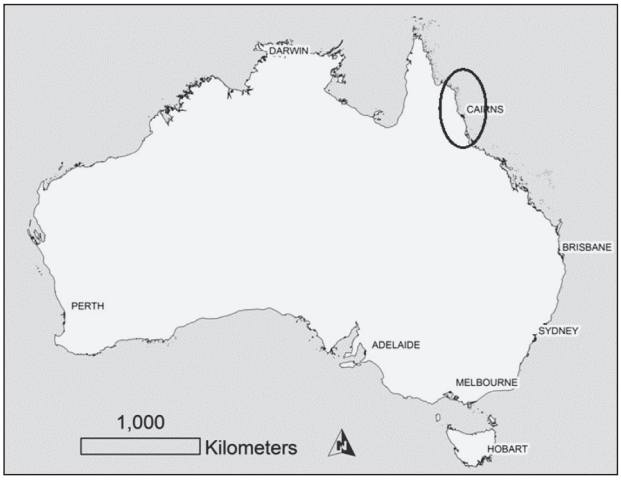

Figure 1. Study area, Far North Queensland in Australia's Wet Tropics.

Why collect pests and weeds data? A literature or internet search quickly highlights that there are almost as many ways of collecting and storing spatial and attribute based records for invasive species as there are invasives. The purpose of this discussion is not to appraise or evaluate individual approaches, but rather to highlight the broad themes encountered in developing a pest mapping project in a regional setting across multiple stakeholders, and to consider this in light of rapid advances in information technology.

One of the key challenges this regional approach has had to overcome has been ensuring that the data collected are available to users after the information has been compiled. Initially this information has been provided back in one kilometre grid maps to users and the public in the form of PDF maps available online – http://www.fnqroc.qld.gov.au/pest/pest_mgmt_mapping.htm. Whilst this has been a major progression from earlier systems there are some limitations in downloading individual species maps at a 1:100,000 scale. This paper discusses some the next steps the project will take in order to communicate to a broader audience in a more interactive process using web server based delivery. One of the key advantages is that this approach offers users the opportunity to not only view and interact with existing datasets but contribute their own data as well.

There are a diverse range of reasons for collecting data on pests and weeds and often this will address both a primary need (e.g. a legal requirement) as well as delivering a secondary purpose (e.g. reporting, research). A pest mapping program contributes to the understanding of an invasive species by adding to our knowledge of invasive biology, including extent of their distribution, and the frequency and duration of the resources required for their management. Data collection can be used for a variety of reasons, such as to meet a legislative responsibility to collect and store information like the application of herbicides; as a strategic planning tool to better understand the spatial and temporal trends in an invasion process; or to report back to stakeholders, funding bodies and industry on the effectiveness of the management approach adopted.

With these aims in mind the end use of information, whether collected as spatial records, attributes/descriptors or both, requires some consideration in order to maintain integrity, utility and currency. Within Australia and the state of Queensland there has been several guidelines (McNaught and Thackway 2006, DEEDI 2009) developed over time to assist data managers to determine the type of data required to report on pests and weeds. This has included the identification of mandatory fields that collect vital information to validate the data and ensure a record can be traced back to its source. The other key function of data management and collection guidelines is to ensure consistency, compatibility and, to a lesser extent, that transparency is maintained across stakeholders.

How end users actually use the information collected in the management of pests and weeds, however, is more defined by conventions in graphic display than by such guidelines. The end result is that the products used to communicate invasive species reflect both the technology and the resources and aesthetics of the day. Historically these transitions have been slow to develop and may have been as simple as the difference between monochrome and colour printing. If you are of the generation that can recall daisy-wheel printers, overhead projectors or had the privilege to use a GPS in the early 1990s you will understand how profound these changes have been. Arguably we are on the precipice of a major and ongoing reinvention of information and how we interact with it. The ascension of the internet as a primary source of information has been so rapid we have had little time to assess either the implications or the opportunities this may present to natural resource managers. The capacity for management data and other GIS derived products to be much more than dots on maps has grown alongside how we frame the spatial and temporal trends in invasive species. This has largely been fuelled by a proliferation of file formats and generic display engines that have dramatically increased the portability of data and the ease of its viewing if not its manipulation. Fundamentally the end result is that we can now create, share and interact with a vast range of spatial data from a new style of user who does not need access to mapping platforms or specialised software to collect and share this information. So the question needs to be asked, how can this new style of user be reached and is there capacity to re-think how we engage community in pest and weed information and management?

The Regional Pest Mapping Project has been underway in the Far North region since 2005 and has seen the ongoing development of data collection, collation and sharing in an environment supported by strong regional partnerships and collaboration across multiple stakeholders. The opportunities offered by these partnerships also present unique challenges of aligning multiple users of data across a variety of scales. In this paper we describe some of the fundamental considerations of a regional pest mapping approach and highlight the ongoing development of methods of collating and communicating data to an ever broadening group of stakeholders.

METHODS

Stakeholders The key contributors to the Regional Pest Mapping Project are from a range of federal and local government and regional non-profit entities. The Far North Queensland Regional Organisation of Councils (FNQROC) is the regional representative body for local government in Far North Queensland and represents five local governments and two aboriginal shire councils. The Herbert Resource Information Centre (HRIC) is a non-profit geographic information systems (GIS) facility that supports decision-makers in the Herbert River Catchment, Far North Queensland. The HRIC is an unincorporated joint venture between local government, industry and natural resource management (NRM) groups. Terrain NRM is the regional NRM body for the Wet Tropics region and is a not-for-profit company charged with facilitating and delivering regional programs that target water health, biodiversity, soil, river, climate, traditional owner and community assets. The Commonwealth Scientific and Industrial Research Organisation (CSIRO) is Australia's national science agency.

History of the project The Regional Mapping Project, a partnership between Terrain NRM, CSIRO and FNQROC collates data from multiple contributors into a 1 km grid by intersecting known point and polygon data with a pre-defined grid overlay (Sydes and Januchowski 2009). The result is a generic grid map that is then further refined in consultation with expert knowledge from on-ground staff. This mapping approach was expanded to include a range of vertebrate pest species in 2008–09 and subsequently further developed in a project led by CSIRO during 2009, which extended coverage into the Dry Tropics and Cape York Peninsula in a study looking at ranges of non-declared and sleeper species using the same methodology.

Applications and species mapped Given the scale of the task of mapping invasives there are some species that have more entire data sets than others. The species with the most complete distribution data are those that have had the focus of dedicated management plans (e.g. pond apple *Annona glabra*, Olive hymenachne *Hymenachne amplexicaulis*); dedicated management

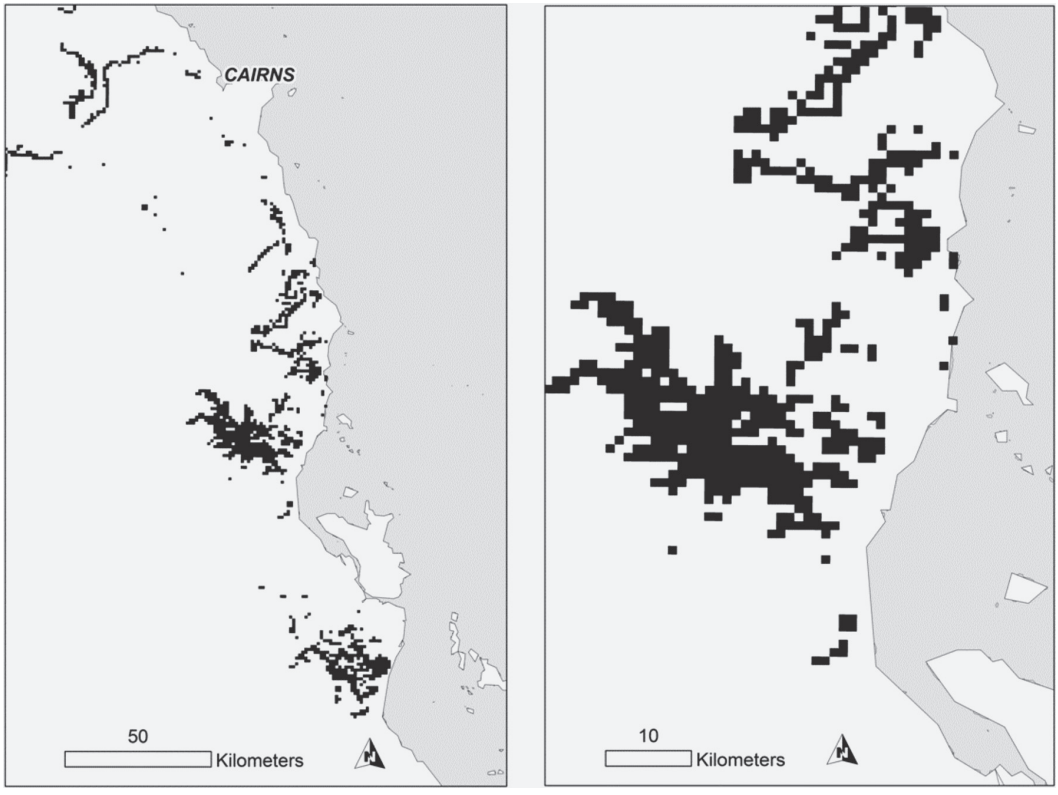

Figure 2. Outputs of the 1 km grid mapping project for *Hymenachne amplexicaulis*, at regional scale (left) and catchment scale (right).

programs (e.g. Siam weed, *Chromolaena odorata*, *Miconia calvescens*) or species that are limited or novel in their distribution (e.g. *Stevia ovata*, *Brillantaisia lamium*, *Hiptage benghalensis*). Vertebrate pests present the challenge of capturing meaningful data on the distribution of mobile and dynamic populations. It needs to be acknowledged that although highly specific data sets are generally quite poor for vertebrate pests like feral pigs, using expert knowledge to gather presence and abundance data is well serviced by the coarse scale of the 1 km grid mapping approach.

Capacity for community involvement Programs and initiatives like Weed Spotters Network, Department of Environment and Resource Management (DERM), aimed at getting members of the community involved in collecting data on the distribution of weeds, have been an effective means to detect and record potential and new weed incursions over recent years. Both the capacity and importance of engaging community to be additional eyes and ears on the lookout for pests is well established by such programs and is the mainstay of extension and engagement programs from all levels of government and industry.

Web portal project development The Pests and Weeds Web Portal (http://www.hric.org.au/home/PestsAndWeeds.aspx) has been launched as a pilot project to gauge the capacity and interest of the wider community and landholders to become more involved in recording and communicating invasive species observations. The portal operates in a web-based delivery environment that utilises off-the-shelf server and enterprise GIS software. Users only require internet access to participate. Registered users are issued with a logon ID and can then access a range of regional mapping and data products for viewing and query in a Google™ Maps environment. Additional utility is provided through ArcGIS enterprise server software for users to record point, line or polygon pest observations using a range of spatial editing tools. The attributes for each record correspond to the SPAS guidelines and are selected from drop down boxes in a form. Users can then tailor and print maps to suit their own interest. Within the trial period, submitted data will be validated in a data upload to an administrator via a weekly email.

The Pests and Weeds Web Portal will operate for a trial period and focus on a select range of cases studies to both demonstrate and fine-tune the application. These case studies and the pilot project will assist project managers to identify the utility, capacity and future development options for the project.

DISCUSSION

Future possibilities The success of the Pests and Weeds Web Portal will be determined not only by the interest from landholders for the access to an online GIS application, but also by the support from stakeholders and agencies to see the utility of the platform and support its implementation.

With the expected rapid uptake of this style of server-based delivery of information and the corresponding development of more accessible GIS hardware and software, it is likely that we will see an exponential increase in the use of such information technology in everyday and industrial applications. With this comes the opportunity to engage stakeholders and community in a more open and real-time dialogue around managing, not just invasive species, but whole-of-systems to ensure we have the right information to make informed decisions with ever-increasing spatial and temporal relevance.

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