Why the polluter pays principle is not a policy panacea for weedy but commercially valuable plant species either

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Summary Accurate assessment and prioritisation of the risks and benefits posed by conflict plant species is needed; these being plants that are both weedy and commercially valuable. When such species are introduced and become invasive, (*sensu* Richardson *et al.* 2000), conflict can arise. This conflict often occurs between those who derive benefits or positive impacts from the plant (e.g. commercial producers) and those who pay for the damage these plants cause when their negative impacts are realised (e.g. environmental custodians; in effect, us the tax-payer). Policy actions and outcomes become mired in this conflict.

Conflict species policy has traditionally been informed by: legislative/regulatory approaches such as noxious weed laws; and economic analyses/tools such benefit cost analyses. These approaches are problematic for various reasons. The polluter pays principle has been proposed to overcome these problems. Broadly, the application of this principle to conflict species would mean that the entity responsible for introducing and/or producing the problem would be responsible for paying for the damage done to the environment/s it invades.

This paper discusses the application of the polluter pays principle to plant invasions. Subsequently, it proposes a fundamentally different process or system of evaluation of the risks and benefits posed by conflict species for informing policy and management responses.

Keywords Conflict or contentious species, Weed Risk Management, negative and positive impacts.

INTRODUCTION

Commercially valuable plant species can become weeds, that is invasive (Richardson *et al.* 2000). This occurs after they are introduced to new areas, cultivated, naturalise away from areas of cultivation, and become weeds (Bennett and Virtue 2004, Ferdinands *et al.* 2011, Johnson 2012).

Policies for the management of these species have focused on legislative/regulatory approaches such as noxious weed laws (e.g. Arcioni 2003, Johnson 2013); and economic analyses/tools such benefit cost analyses (e.g. Ferdinands *et al.* 2010). The disadvantages of both approaches have been discussed elsewhere (Le Gal 2011, Johnson 2012). A different approach is needed.

A potentially larger range of market-based mechanisms have more recently been investigated (e.g. Martin and Le Gal 2010, Le Gal 2011, 2012). Among this alternate regulatory mix is the polluter pays principle. Theoretically, the application of this principle will mean that industry, upon introducing or producing an environmental problem, will be responsible for paying for the damage the problem causes. Applied to plant invasions, it means that industry pays for the negative impacts that are realised after the introduction of such a species.

The polluter pays principle has received recent popular attention as one of four key strategies to reduce future problems with the introduction of new pasture species (Driscoll *et al.* 2014). Although a useful contribution to the literature, that analysis overlooked earlier, superordinate literature examining the polluter pays principle (e.g. Knowler and Barbier 2005, Barbier and Knowler 2006). In particular, those earlier authors examined the introduction of a 'Pigo[u]vian tax' consistent with the principles of an "introducers' pay" tax. This paper discusses the concepts of an "introducers' pay" tax. It then discusses if the introduction of an "introducers' pay" tax should be added the suite of invasive species management practices. In light of this, the paper suggests an alternate process for the evaluation of the risks and benefits from conflict species to inform policy and management.

A PIGO[U]VIAN TAX AND THE ISSUE OF EXTERNALITIES

Pigo[u]vian tax The original arguments for a Pigouvian tax were proposed nearly a century ago (Pigou 1920). (This paper uses the less common spelling 'Pigouvian' throughout this paper). In essence, a Pigouvian tax is a market-based tax that is levied on any activity that generates negative externalities, that is an externality not internalised in the market price. Such a tax is intended to correct an inefficient market outcome, that is a negative externality/ies. It addresses

these by introducing, taxing and/or setting a social cost.

The sale of alcohol was used to illustrate the application of this tax (Pigou 1920). The sale of alcohol, unfortunately, often necessitates an increase in policing and prisons, because of the crime associated with that sale. The private benefit accruing to the owners of liquor outlets is large when compared to the negative social impacts that such sales often cause society more generally. Pigou (*ibid*.) suggested that individuals receiving benefits had no incentive to pay for the flow on costs that came to be associated with their business (e.g. the policing and prisons) and that this was the reason most countries taxed alcohol-related businesses.

The legislative management of weeds and the issue of externalities It is useful to consider externalities more generally at this point. In particular, it is important to consider the externalities that are addressed in legislative/regulatory approaches to weed management, such as those surrounding noxious weed laws. Although varying in type, the experience of externalities in weed management is similar to the example above.

To revise, in general, an externality occurs when the actions of individuals impose unintended impacts on others (Blackmore 2008). That reference further states:

> '*Externalities occur as both external costs and external benefits. People who have external costs imposed on them are not compensated for their loss, while people who receive an external benefit are not required to pay for their good fortune…The existence of externalities may justify governments making laws to correct the cause of the externality for the benefit of the community as a whole*';

and with respect to externalities encountered in weed management:

> '*When weeds spread to new areas, the landholders in the newly infested areas suffer economic losses because of the weed spread. These losses may include the cost of control work, loss of production, loss of biodiversity or loss of an amenity value. The landholders are not compensated for these losses by the owner of the land from where the weed spread.'*

For this reason, state and territory governments in Australia attempt to manage the problems caused by negative externalities related to weed management by making laws to require land managers to control particular weeds before they spread further (Blackmore *ibid*.).

The implementation of a market-based instrument such as a Pigouvian tax that is consistent with the "introducers' pay" concept would also seek to address this negative externality. That is, it seeks to address the costs of weed spread to affected landholders. Application of a Pigouvian tax **assumes that the social costs of the negative externality can be calculated, and applied in monetary terms**. While calculation of the costs that apply to this negative externality are fundamental to the concept of an "introducers' pay" or pollution tax, there is often less attention paid to: i. doing so (excepting Knowler and Barbier 2005, Barbier and Knowler 2006); and, if these costs are able to be calculated with any reliability; then ii. how such concepts may be implemented. Testing to see if a pollution tax can be calculated, and then examining how it can be implemented to weed management seem to be crucial first steps before application. Accordingly, these are discussed in this paper.

TESTING THE POLLUTER PAYS CONCEPT

Calculating a polluter pays tax Complete knowledge of a market, while desirable, is not possible (Knowler and Barbier 2005, Barbier and Knowler 2006). Complete knowledge of the costs incurred by all affected landholders for weed management is similarly desirable, but unattainable (Johnson 2014). In particular, the negative impacts of weeds are either partly (de Wit *et al.* 2001), or mostly unmeasured or unknown (Hughey *et al.* 2003, Heikkila 2010). This introduces significant uncertainty into any analysis.

Having said this, using the introduction of a desirable but invasive plant species through nurseries as an example, a key assumption is that:

> '*Economic theory suggests that an unregulated nursery industry would* ***not*** *take into account the risk of invasion posed by the exotic species that it markets…as if there was* ***no risk of invasion****'* (Knowler and Barbier 2005, emphasis mine).

This assumption is sensible because in many cases the introduction of the plant species does not result in naturalisation out of a 'restricted or controlled environment' (Barbier and Knowler 2006): an important corollary of this fact is that not all plants introduced to a new environment naturalise, nor become invasive (e.g. Johnson 2014).

In contrast, the policy dilemma Knowler and Barbier (2005) identified is to allow the industry selling a plant that will become invasive through nurseries, and that industry to grow to an optimal size but no further (to maximise the profits and positive impacts and to minimise the weedy and negative impacts). Internalising the risk to industry via a Pigouvian tax or charge will restrict the number of outlets selling the plant to an optimal number instead (Knowler and Barbier 2005, Barbier and Knowler 2006). The magnitude of

the tax will be dependent upon many factors including: the economic (including environmental) conditions when the invasion occurs; the sensitivity of the risk of invasion to the introduction of further sellers (that is potential propagule sources); not to mention the invasion rate. Using historical data on the introduction of *Tamarix* spp. (Knowler and Barbier 2005) and *Lythrum salicaria* L. (Barbier and Knowler 2006) into North America, they suggest that the: i. 'problem of plant invasives initiated by commercial operations is amenable to standard economic analysis and solutions…by the introduction…of an "introducers' pay tax"' (Barbier and Knowler 2006); ii. mere presence of a risk of invasion from a plant species does not mean it is socially optimal to prevent sales of the species; iii. optimal number of nurseries selling the plant is always higher when there is no risk of invasion (but the marginal risk of invasion was important in influencing the outcome); iv. higher the risk of invasion, the lower number of nurseries and the higher the rate of tax was needed; v. value of the introducers' pays tax was sensitive to the profitability of the plant species; and vi. plant species should not be sold when the risk of invasion exceeds a threshold (they appropriately suggest pre-border screening of such species in these cases): the Australian government currently operates such a system (e.g. Pheloung *et al.* 1999).

The introduction of a polluter pays tax is theoretically possible, but only after making a series of assumptions, sometimes self-reported as 'heroic' (Knowler and Barbier 2005). In addition, the solution values derived 'cannot be used for policy purposes' (Barbier and Knowler 2006). A notable statement oft repeated was that reliable data to support these analyses was either not available (Knowler and Barbier 2005, Barbier and Knowler 2006), or required considerable temporal and economic investment (Johnson 2012).

Application of a polluter pays tax As outlined above, unfortunately, and unless specific detailed data sets are available for species, it is very unlikely that a pollution tax can be applied as a policy-based instrument for managing conflict species.

A FUNDAMENTALLY DIFFERENT WAY

The policy dilemma posed by any conflict species is to balance the risk of invasion (potential negative impacts) presented by its introduction and sale against the economic benefits to industry and society that derive from its introduction (potential positive impacts). As demonstrated above, and earlier (Johnson 2012), doing so in a data-variable environment remains a key challenge.

In light of this, a fundamentally different process or system of evaluation of the risks and benefits posed by conflict species is needed, one that is: scientifically rigorous; repeatable (particularly when used by assessors of variable skill levels); best-practice; and defensible. Ideally it should also be: user-friendly; able to assess a range of different species; able to make use of scientific data when available, any observations where necessary, but not be totally dependent on these; allow for assumptions to be made, and reference material used to be explicitly stated; able to be applied to a range of different scales; and, importantly, allow for revision when new information becomes available.

Semi-quantitative systems that systematically examine the negative impacts of invasive species are widely used (e.g. Johnson 2009, Downey *et al.* 2010, Auld 2012, Auld and Johnson 2014, Steel and Johnson 2015). It is proposed that such negative impact assessments form an integral part of a future system of evaluation (Johnson 2012). A set of positive impact assessments is needed, probably similar to those proposed elsewhere (Johnson 2012). Consultation with key economic, environmental and societal stakeholders, including government and industry, will allow for joint implementation of policy and management responses (Johnson 2010).

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