What every biocontrol researcher should know about the public

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Summary
Classical biological control is a public-interest science. This places a special responsibility on researchers and practitioners to communicate to the public about their activities and the benefits these provide to them. More than many other forms of science practice, biological control requires understanding public perceptions of their work and a coordinated effort to communicate with the public. Publicly addressing the risks of classical biological control introductions can foster a public consensus on appropriate risk-management strategies.

Keywords: public-interest science, risk perception, risk management, public outreach.

Introduction
The practice of classical and conservation biological control is a public-interest science, done on behalf of the public and generally with public funds. The kind of knowledge produced by classical and conservation biological control work is of a public good character, meaning that it is non-rival and non-excludable; in other words, it is a pure common resource. Biological control research does not result in commodifiable knowledge (e.g. patents), and this trait distinguishes this form of scientific activity from many others. Consequently, as products of this science are not amenable to private property right protections, its practitioners - usually employees of public agencies or publicly funded universities - rely upon public funds to do their work. Thus, practitioners in the field of biological control have a special need to understand the public and cultivate public support for their work.

Declining public funding threatens to undermine the institutional capacity for biological control. The discovery of some nontarget effects has led some ecologists to assert that biological control is inherently risky and that much more precaution is necessary (Howarth, 1991; Lockwood, 1996). Thus, over the past two decades, critics, practitioners and regulators have publicly debated norms and policies that might apply to biological control. Several countries have implemented new regulations, prompting what some have described as an emerging regulatory crisis (Sheppard et al., 2003). Biological control researchers have long recognized the importance of cultivating public trust and support, which are critically necessary for policy support and public funding (van Lenteren, 2004, 2006). Members of the International Organization for Biological Control (IOBC) are advancing persuasive arguments that, while no pest-management strategy is risk free, biological control is often the safest and most cost-effective approach (van Lenteren, 2004; Delfosse, 2004, 2005). These kinds of initiatives are essential to sustain public funding and policy support for this scientific practice.

The relationships between scientists, scientific knowledge and the public are critical - yet contested - issues in the modern world and central to making progress toward a more sustainable relationship between humanity and the biosphere. In this paper, we report our research into the ways that public attitudes, public communication and public initiatives affect the practice of biological control. Many social scientists have analysed efforts to improve science communication and policy, and thus we begin by placing our work in this broader context. We will first review the obstacles and challenges illustrated by prior studies that underscore the importance of the public communication of science. We then report original data from field work in Canada and California on the relationship between

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Regardless of what one thinks of these technologies, the public outreach strategy for genetically modified organisms (GMOs) in the UK was a disaster. Many science communication scholars could have predicted this outcome because prior research in this field has consistently revealed that the critical issue is not scientific illiteracy of the public but rather the uneven levels of public trust in expert scientists and the political regulatory institutions (Rampton and Stauber, 2002). Studies have demonstrated that more knowledge communicated to the public about a controversial scientific practice can very easily result in amplifying rather than diminishing public fears (Gregory and Miller, 1998). At least in advanced industrial societies, most people generally trust, and thus filter out, scientific knowledge and technologies as a matter of routine. Querying the general public about their opinions regarding a scientific practice about which they know little may provide them with specific information that they find disturbing. Consequently, while science practitioners may use new findings to increase the level of public knowledge, building trust may be a more effective strategy. Therefore, any effort to communicate expert knowledge to the public must also seriously address the need to establish credibility and foster trust. The interdisciplinary

Communication, science and the publics

Scientists often avoid speaking to lay, public audiences and to the media, as their statements are often misquoted, taken out of context, clipped and distorted, sensationalized or even ridiculed (Hayes and Grossman, 2006). While these are valid reasons, our modern world consequently suffers greatly from the broad problem of scientific illiteracy. However, the low ‘public acceptance’ of transgenic seeds/genetically modified organisms in the United Kingdom should serve as a cautionary case study for anyone with simplistic ideas about ‘the problem’ of ‘public resistance’ to a novel technology. Both the transnational corporations and government agencies involved in the development and regulation of transgenic organisms have behaved as though the public merely lacked information and that increasing the available knowledge would remedy the situation. During the 1990s, as more information was conveyed to the British public, public skepticism markedly increased. While the promoters of this technology did recognize the problem of scientific illiteracy, they proceeded to attack what they perceived as emotional responses, the public misperception of risk and irresponsible media coverage. One social scientist described their approach as an exercise in creating public alienation (Wynne, 2001).

What do we know about what the public thinks about biocontrol?

In North America, two social science surveys have assessed public knowledge about biological control, one in California and the other in Canada. The ash whitefly, *Siphonia philyrea* (Haliday) (Homoptera: Aleyrodidae) was introduced into California’s urban landscape, causing millions of dollars of damage through defoliation. The California Department of Food and Agriculture’s Biological Control Program introduced a parasitoid, *Encarsia tanaron* (Walker) (Hymenoptera: Aphelinidae) which established and provided a highly successful control effort (Pickett et al., 1996) that provided between 219 and 298 million US dollars in benefits to the public. However, shortly afterward, the budget of California’s overall Biological Control Program was cut, resulting in half of the permanent scientific staff being let go. This program was vulnerable to such vagaries of California State funding because it did not have a dedicated revenue stream, nor did it have sufficiently powerful political allies.

To assess potential public support for such a revenue stream, Jetter and Paine (2004) surveyed consumers about their economic preferences for three strategies (chemical pesticide, biorational insecticide or introduced natural enemy) in controlling an invasive pest of urban forest landscapes. They provided respondents a booklet with background information on these pest-management options and asked urban homeowners to report their relative willingness to pay for them. The findings suggested that social and financial support by urban residents could be tapped to fund the introduction of classical biological control agents for landscape pests.

Under the auspices of the Canadian Biological Control Network, several Canadian researchers conducted a Canada-wide telephone survey in 2005 to determine public perception of biological control as an alternative to the use of traditional pesticides and GMOs (McNeil, personal communication). Here the thrust was to assess the perceived risks of these three pest-management options. Although the data from this survey are still being analysed, initial findings indicate that Canadians generally consider biological control to be safer than conventional agrochemical pesticides in agriculture. The findings also indicate that Canadians, especially those of middle age, would like more information about pest-management strategies used in their food production, a finding consistent with other surveys about how much information consumers would like about the conditions of their food production (Eilenberg and Hokkanen, 2006).
A fundamental limitation of these types of surveys is that they assess public opinion, not actual behavior. Neither of these surveys query who among the public would actively participate in deliberations about the importation of biological control agents or funding for such initiatives if the opportunity arose. However, in the USA and Canada, there is no formal process for soliciting public input into biological control importation decisions (Mason et al., 2005). Thus, other participants in the administrative policy process must represent the public interest.

**Identifying clients for biological control**

Warner and Getz have been conducting a study since 2004 of the social and economic factors in California serving as obstacles and opportunities for further implementing biological control in agriculture. Our work reveals the critical role of two institutions that recognize the value of biological control: county agricultural commissioners and growers’ groups. Agricultural commissioners are appointed by locally elected county officials, and thus they are responsive to local residents. Commodity board research directors are hired by organizations of farmers, and they understand their role to be supporting the kind of research that will serve the needs of their farmers. Interviews indicate that both play a critical intermediary role for county residents/taxpayers and large groups of growers, which are two groups interested in pest management. The dynamic works like this: when an urban landowner or a farmer of a specific commodity has a problem with a new pest, s/he contacts the agricultural commissioner or commodity board research director, who, in turn, contacts a university specialist or state program researcher. The commissioners and research directors function as key intermediaries, or knowledge brokers, from land managers to the knowledgeable expert, who then, if appropriate, conduct research and share information in turn with these intermediaries. This arrangement works well, as long as the research institutions are properly funded, but as the section above narrates, this is not presently the case. Scientific knowledge is circulating through this system, but because political knowledge about the benefits does not, financial resources are erratic.

The evolution of environmental regulations in California has made conventional insecticides increasingly more difficult to use. Consequently, both urban landowners and farmers are generally open to considering biological control if it proves effective and affordable. However, even these groups, who are able to identify the value of university and state biocontrol programs, know very little of the budgetary constraints faced by the scientists carrying out the research. An opinion survey of land owners and farmers would likely indicate support for these researchers (and any other expert knowledge that could help them) but does not automatically follow that this public’s interest will be transmitted to government funders.

Our interviews with agricultural commissioners and commodity board research directors indicate that they are quite aware of, and concerned about, the diminishing institutional capacity of the University of California and the state Biological Control Program. Their professional responsibilities include helping (urban and agricultural) land managers control pests and ensure they conform to environmental regulations. Research directors are particularly concerned that the number of scientists conducting practical research in biological control has declined significantly over the past few decades. One noted that she could provide funding for any genuine biological control proposal that had the potential to advance knowledge of that crop’s farming systems but that the number of researchers in the field has diminished significantly. Another, representing a major crop in the state, said that there was only one scientist in California that could help him with one of his major pests.

The agricultural commissioners who are often the first officials to receive a phone call from a distressed landowner have legislatively mandated responsibilities for protecting their county from noxious weeds and insects and also for enforcing state pesticide laws. Thus, they too experience the tension of having to coordinate pest-management efforts but within the limitation of existing laws. Consequently, they are among the most active consumers of the research knowledge and the biological control agents provided by California Department of Food and Agriculture (CDFA)’s Biological Control Program. They advocate for funding this program, but they are somewhat constrained as their own county activities depend on the State Secretary of Agriculture for funding.

One particularly noteworthy institutional vehicle for building public support for funding has been the California Weed Management Area Support Program (California Department of Food and Agriculture, 2006). With relatively modest state funding, this program has fostered local networks of concerned landowners and agencies to focus attention on noxious weeds. It has leveraged US $5.4 million of state money to attract over US $7 million of additional funds, but more important has been its ability to provide a vehicle for local landowners to coordinate their efforts and educate the public. Weed-management areas (WMAs) provide the social infrastructure to cooperate in a meaningful way with the state’s Biological Control Program. The current WMAs rest on a long history of coordinated pest management in California (Baker, 1988; Warner, 2007). They are essential for coordinating widely dispersed weed-management activities but also for activating existing social networks to advocate for continued funding. Members of the public who have benefited from coordinated weed eradication are much more likely
to provide the political support for biological control. One landowner who has benefited by such a program is much more likely to take action in support of biological control than one million consumers who express a favorable opinion on a mass survey.

**Public initiatives on behalf of biological control**

From the observations above, it seems that biocontrol is a terrific pest-management strategy but that it faces worrying trends. Science funding and policy in the industrial countries now operate in a new, more challenging political context. No scientists can count on stable funding or policy work. This is particularly true of a public-interest science and one that must now confront the 'controversies' of non-target impacts. We therefore recommend that the biocontrol community develop strategic alliances with several potential 'publics'. Developing coordinated science communication policy requires more work but few financial resources.

Biological control has five publics, with different communication needs: client communities (land managers and farmers); funders (interested in pest management and invasive species); regulators; potential scientific allies (public-interest ecologists interested in pest-management alternatives); and contrarians (scientists who are philosophically opposed to biological control). Communicating with these five requires a carefully targeted message. An example of this kind of linking of research and public communication can be found in the Ecological Society of America's 'Sustainable Biosphere Initiative' (SBI) presented by Lubchenco et al. (1991), described by Lubchenco (1998) and analysed by FitzSimmons (2004). The SBI has developed research briefs for policy makers through their 'Issues In Ecology' publications, and this kind of effort could be copied by the biocontrol community. A 'biocontrol science communication working group', perhaps coordinated by the IOBC, could engage policy makers by presenting the value that this science could represent the public value of biological control in the public sphere. The commodity organizations and WMAs are excellent examples of how this kind of partnering can bear fruit.

3. Strategic analysis suggests that favouring outreach efforts which cultivate partners and clients who can serve as credible messengers to public policy makers and funders is likely to be more fruitful than efforts to outreach to generic public ‘masses’.

4. Recognize that most publics evaluate your work not on the basis of scientific knowledge or its merit but rather on trust. Build trust through collaboration with credible partners, and be transparent about risks, risk-management efforts, peer review and the value of client participation in this work.

5. Do this as a group, through institutions and networks, to justify biological control for its public good features (not because of original scientific discovery). Emphasizing the public good features of biocontrol can convert passive acceptance into active advocates for funding and supportive policy. Partners can serve as credible messengers, conferring legitimacy to your work and increasing the likelihood of funding for providing pesticide alternatives and strategies for controlling invasive species.

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