

Institution: Swansea University		
Unit of Assessment: 7		
Title of case study: Improvement to UK legal practice and economic benefits through identification of best practice in Japanese Knotweed control		
Period when the underpinning research was undertaken: 2011- 2020		
Details of staff conducting the underpinning research from the submitting unit:		
Name(s):	Role(s) (e.g. job title):	Period(s) employed by submitting HEI:
Daniel Eastwood Michael Draper Dan Jones	Professor Professor PhD candidate Honorary Research Associate	2011- Present 2004-Present 2011-2016 2015-Present
Period when the claimed impact occurred: 2014-2020		
Is this case study continued from a case study submitted in 2014? No		
1. Summary of the impact Our research on Japanese knotweed control has had socio-economic, environmental and legal impact. Following the largest ongoing field trial of industrial control methods for Japanese Knotweed, we identified best practice for the long-term management of this invasive weed. These findings effected benefits in two key areas: A) widespread improvement in Japanese knotweed management practice through stakeholder engagement and the start-up company Advanced Invasives, and uptake of our best practice guidance as a benchmark standard in civil court cases, and B) change to the Law Society of England and Wales conveyancing TA6 documentation recognising most knotweed control plans do not eradicate the plant. The latter affects ca. 1,000,000 conveyancing events per year in England and Wales.		
2. Underpinning research The Plant: In the UK, Continental Europe and North America, Japanese knotweed (JK) is a widely distributed invasive plant which: 1) dominates habitats, reducing biodiversity; 2) reduces amenity value of properties and recreational areas; and 3) impacts house sales and land usage. JK is a large plant that produces extensive belowground rhizome (root) networks, which support rapid early season aboveground growth that outcompetes native plants. Rhizomes extend several metres in diameter and depth from aboveground growth, retain capacity for extended dormancy and consequently, are resilient to many control treatments. The Problem: Despite costing ca. GBP165,600,000 p.a. to manage JK infestations in the UK, prior to our research, no field or pot-based test had been sufficiently scaled to account for several metres of horizontal rhizome extent and none had simultaneously tested physical treatments, all EU registered herbicides, application methods and integrated (physical + chemical) treatments. UK Environment Agency's "<i>The Knotweed Code of Practice</i>" (2006, 2013) and UK JK control industry management method selection was therefore undermined by insufficient empirical data, providing little clear stakeholder guidance for herbicide selection. Within the information vacuum, reputable companies and trade bodies acting in their clients (and stakeholders) best interests were pitched against others providing untested, ineffective and costly control methods to the detriment of the industry and wider environment. Indeed, the UK Government withdrew <i>The Knotweed Code of Practice</i> in 2016 recognising increasing civil liability claims around JK encroachment and mismanagement, and deficient empirical data supporting it. The Research: This was undertaken with an industry-sponsored EU convergence programme-funded grant [G1] 2011-2015 by Eastwood and Jones and longer-term field assessment research from 2015-present. The latter was a collaboration between SU and start-up company Advanced Invasives Ltd. Nineteen marketed JK treatment methods were tested for ability to control JK infestation. As well as allowing comparison of approach in a single study, the key innovation was the unique size of the randomised 225 m² treatment plots and >3-year assessment duration providing the largest and longest running (2011-present) infield assessment of JK control.		

We showed that effective JK control is achieved using glyphosate, applied biannually as a spray in summer and autumn, or annually in autumn via injection or spray [R1]. We recommended treatment approaches that integrate with above- and belowground mass flow movement within the plant, an approach we termed “**the Four-Stage Model**”. Notably, labour-intensive physical treatments and some herbicides with on-label approval for JK control were ineffective when evaluated at field-scale: we recommended their deletion from JK control guidance. Critically, no single treatment effected full control and management plans should include multiple years’ treatment. Furthermore, while glyphosate provides good control of aboveground growth, the belowground rhizome is dormant and still viable [R1-R2].

The legal ramifications of herbicide-induced belowground JK dormancy to the Law Society’s conveyancing document TA6 was outlined by **Draper** and **Eastwood** in a Law Society of England and Wales discussion document [R3]. The inaccuracy of the wording in the TA6 documentation discussed in **R3** led in 2018 to engagement with the Law Society’s Conveyancing and Land Law Committee and subsequent acceptance of the need to change the existing TA6 form.

3. References to the research

Swansea University authors in bold.

- [R1] **Jones, D.**, Bruce, G., **Fowler, M.S.**, Law-Cooper, R., Graham, I., Street-Perrott, F.A., **Eastwood, D.C.** (2018). Optimising physiochemical control of invasive Japanese knotweed. *Biological Invasions* 20(8): 2091-2105. <https://doi.org/10.1007/s10530-018-1684-5>
- [R2]. **Jones, D.**, **Eastwood, D.** (2019). Sustainable control of invasive Japanese knotweed. *Outlooks in Pest Management* 30(5): 195-200. https://doi.org/10.1564/v30_oct_02
- [R3]. **Draper, M.**, **Eastwood, D.** (2018). Law Society Property Section Magazine: A Knotty Problem. <http://communities.lawsociety.org.uk/property/magazine/september-2018/a-knotty-problem/5065743.article>.

Grants

- [G1]. KESS1 Award to Swansea University, co-funded by Welsh Government and Complete Weed Control Ltd: GBP68,089.

[R1] is an important study as it describes a large, multi-year and industry-relevant field assessment (225 m² replicated treatment plots, over 2 sites assessing 19 different chemical and physical treatment approaches). Citation and Altmetric data (Sept 2020) showed the open access article to have been highly regarded by both scientific and wider community:

- Downloaded over 20,000 times since publication in April 2018.
- In the 97th Percentile (438,859) of the 16,033,924 research outputs tracked and in the “top 5% of all research outputs ever tracked by Altmetric”.
- In the 94th percentile, ranked 14,661 out of 280,313 articles of a similar age in all journals and is ranked 41st out of 1,792 Biological Invasions outputs.

[R2] assessed Japanese knotweed control practice aimed specifically at explaining our guidance to land managers and control practitioners as well as an academic audience. It incorporated evidence of additional years’ field assessments since [R1].

[R3] This is the first discussion piece that highlighted that there was an issue with the wording of the then TA6 documentation. The article is recognised by the Law Society and its practicing members as creating ambiguity for the courts and the need to amend the wording in the TA6 form. (Please note, the practice of law recognises discussion within professional periodicals as disciplinary outputs).

4. Details of the impact

(A). Uptake of improved Japanese knotweed management practice in the UK

Prior to and since [R1], **Eastwood** and **Jones** engaged government, industry and land managers to promote evidence-based best practice of JK control. As a result of [G1] and [R1], Advanced Invasives Ltd (**Ai**) was founded by **Jones** in 2016 to deliver in-field research and product testing, expert witness services, complex site surveying, and best practice training and guidance using the four-stage model. While a UK-wide problem, Wales has the highest infestation levels outside of JK's native range and therefore provides leadership in developing best practice internationally.

Post [R1], **Swansea University** and **Ai** have provided evidence-led management guidance to significant landowners, e.g. Welsh Government (WG), Network Rail Infrastructure Ltd, Wales and Borders at Network Rail [C1-C3]. Our JK working standards guidance as defined in [R1] and [R2], adopted throughout Wales, was further supplemented by **Ai**-commissioned community guidance [C4] to raise public awareness levels through the WG landscape website (173 downloads August to December 2020).

- *"WG and its sponsored body, Natural Resources Wales (NRW) manage, operate and own 7% of Wales' land area (more than 14,500 hectares) Welsh Government adopted the practical application of the Swansea research for knotweed control, for example the South, North and Mid-Wales Trunk Road Agencies now manage c1,300 km of road assets according to this research" [C1, Chair of the Wales Biodiversity Partnership Invasive Non-Native Species Group].*
- *"Over the past two years, practical application of the Swansea research for knotweed control has helped us to better manage extensive plant growth across 2,700 kilometres of track and 671 affected properties through reduced treatment frequency and shorter effective treatment timeframes. the use of glyphosate-based herbicide cuts long-term management timeframes from an indeterminate duration (greater than 10 years) to greater than 95 % control of knotweed plants within 2-3 years of the initial treatment." [C2, Regional Asset Manager, Wales and Borders Network Rail].*
- *"Jones et al. research has been adopted by all local authority partners in our latest INNS controls programme covering eight local authority areas in South Wales" [C3, Invasive Plant Species Officer – Caerphilly County Borough Council].*

Trade bodies and national companies have also adopted our guidance:

- *"In my role as Chair I have heard from many members that they are applying aspects of Dr. Jones's 2018 research with regards to knotweed management and it has saved them time, money and labour" and "The Amenity Forum needs evidence-based research to inform best practice, reduce environmental impacts and inform policy makers. As such, the Japanese knotweed research conducted at Swansea University is vital to helping us to achieve our standards-raising objectives" [C5, Chair Amenity Forum Trade Org UK]*
- *"Following the release of this research, Knotweed Services (UK) Ltd now operate using the 4-stage model which identifies the optimal time for treatment" [C6].*

As the number of legal cases relating to JK have increased, businesses and land managers have adopted our research to demonstrate best practice guidance in court cases where improper treatment or JK encroachment through poor management is brought by a plaintiff. Conversely, plaintiffs highlight [R1] recommendations in cases where inadequate control methods have been employed.

- *"Jones et al provided much needed empirical data for defining appropriate Japanese knotweed management. It has been formative in establishing the scope of the 'measured duty of care' for a party with this 'natural hazard' on their land." [C7, Barrister, Hardwicke Law].*

(B). Change to The Law Society of England and Wales conveyancing TA6 documentation.

Eastwood and **Draper's** article [R3] addressed the legal implications for the inappropriate use of the term eradication when the plant could be dormant belowground without a house seller being aware. Consequently, **Draper's** active engagement with the Law Society (guided by **Eastwood**) coincided with a House of Commons Science and Technology Select Committee report (to which **Jones** had provided verbal and written depositions, [C8 pages 11,16, 26]) that recommended the LS review wording of the question in its Property Information Forms [C8, page 37, recommendation 6].

The TA6 required sellers to disclose (a) whether JK was or was not present on the property, and (b) whether a management plan was in place to "eradicate" JK if present. The Law Society accepted our arguments in [R1-R3] that eradication was an inappropriate term and a seller might not know whether belowground dormant rhizome was present. As a result, TA6 was updated to include a "don't know" option for (a) and "eradication" in (b) was replaced in guidance with wording drafted by **Draper, Eastwood** and **Jones** that acknowledged the difficulty in promising eradication even after a lengthy treatment plan. These changes were enacted in February 2020 (TA6; 4th edition) and is used for house sales in England and Wales by all Law Society members. The chair of the Law Society's Conveyancing and Land Law committee noted:

"The main impact of this change has been to remove the ambiguity on liability if belowground dormant Japanese knotweed is present for all house sales using the TA6 form (for reference and scale, approximately 1 million residential property transactions are carried out in England and Wales per annum). It will also allow more informed decisions to be made on lending on affected properties that have a clear management plan in place, which I expect will lead to more mortgage offers being approved [C9]."

5. Sources to corroborate the impact

- [C1] Testimonial letter, Chair of the Wales Biodiversity Partnership Invasive Non-Native Species Group
- [C2] Testimonial letter, Regional Asset Manager, Wales and Borders Network Rail
- [C3] Testimonial letter, Invasive Plant Species Officer – Caerphilly County Borough Council
- [C4] Jones D (2020). Public information on invasive species in Wales: Japanese knotweed. Welsh Government. Source: <https://bit.ly/3gHbpks>.
- [C5] Testimonial letter, Chair Amenity Forum
- [C6] <https://www.knotweedservices.co.uk/residential/>
- [C7] Testimonial letter, Barrister, Hardwicke Law
- [C8] HCSTC (2019). House of Commons Science and Technology Committee Report: Japanese Knotweed and the built environment. House of Commons, 8 May 2019. Source: <https://publications.parliament.uk/pa/cm201719/cmselect/cmsctech/1702/1702.pdf>
- [C9] Testimonial letter, Chair of the Law Society's Conveyancing and Land Law