Risk Assessment of *Juncus planifolius*

Name of Organism:	*Juncus planifolius* R. Br. – Broad-leaved Rush
Objective:	Assess the risks associated with this species in Ireland
Version:	Final 15/09/2014
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Expert reviewer	Dr Matthew Jebb - National Botanic Gardens

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About the risk assessment

This risk assessment is based on the **N**on-native species **AP**plication based **R**isk **A**nalysis (NAPRA) tool (version 2.66). NAPRA is a computer based tool for undertaking risk assessment of any non-native species. It was developed by the European and Mediterranean Plant Protection Organisation (EPPO) and adapted for Ireland and Northern Ireland by Invasive Species Ireland. It is based on the Computer Aided Pest Risk Analysis (CAPRA) software package which is a similar tool used by EPPO for risk assessment.

Notes: Confidence is rated as low, medium, high or very high.
Likelihood is rated as very unlikely, unlikely, moderately likely, likely or very likely.
The percentage categories are 0% - 10%, 11% - 33%, 34% - 67%, 68% - 90% or 91% - 100%.
N/A = not applicable.

This is a joint project by Inland Fisheries Ireland and the National Biodiversity Data Centre to inform risk assessments of non-native species for the European Communities (Birds and Natural Habitats) Regulations 2011. It is supported by the National Parks and Wildlife Service.

DOCUMENT CONTROL SHEET

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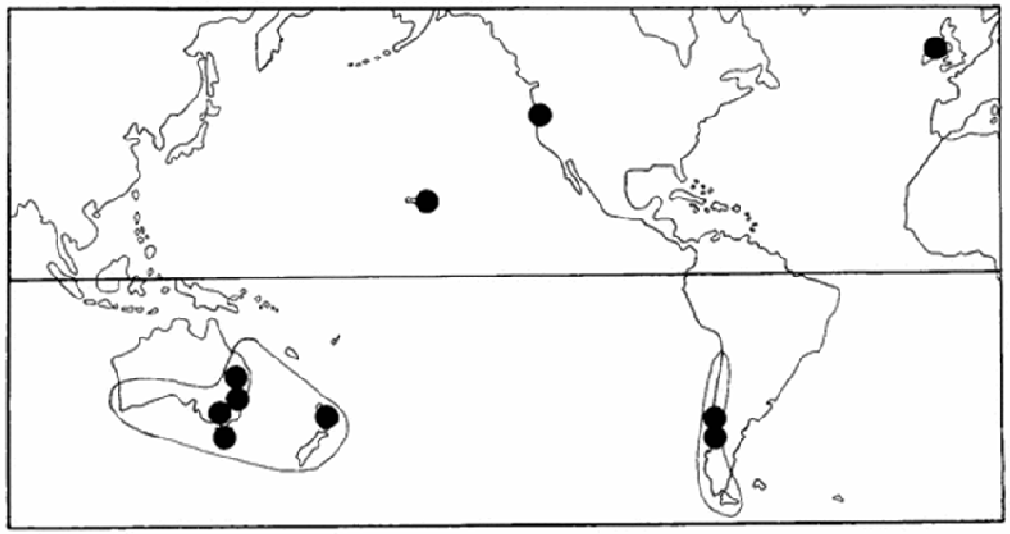
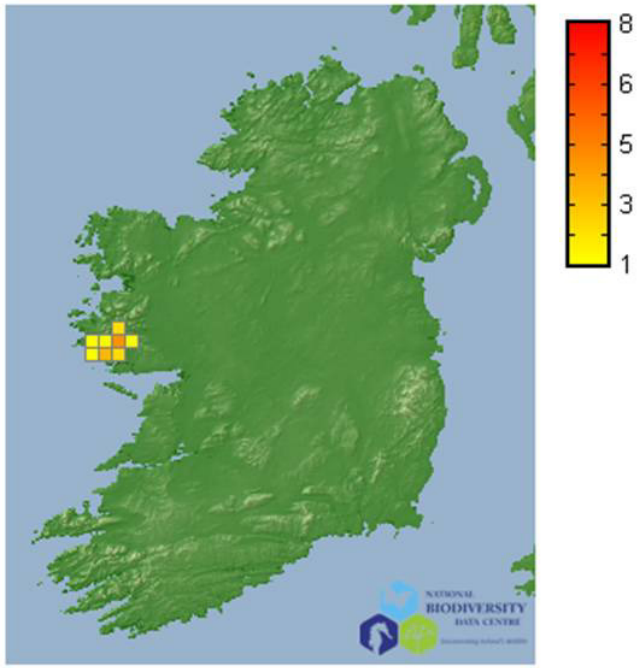
Final	Complete	Dr Erin O'Rourke	Dr Liam Lysaght	Dr Liam Lysaght	115/09/2014

Stage 1 - Organism Information *The aim of this section is to gather basic information about the organism.*			
N	**QUESTION**	**RESPONSE**	**COMMENT**
1	What is the reason for performing the risk assessment?		A risk assessment is required as this species is listed as a "Non-native species subject to restrictions under Regulations 49 and 50" in the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations 2011, SI 477/2011.
2	Identify the organism. Is it clearly a single taxonomic entity and can it be adequately distinguished from other entities of the same rank?	YES	*Juncus planifolius* R. Br. – broad-leaved rush Taxonomy: Kingdom: Plantae Phylum: Tracheophyta Class: Liliopsida Order: Poales Family: Juncaceae Genus: Juncus Species: planifolius Synonyms: *Juncus demissus* Steud., *Juncus homalophyllus* Steud., *Juncus planifolius* var. *chathamensis* Buchenau, *Juncus planifolius* var. *demissus* (Steud.) Buchenau, *Juncus planifolius* var. *humilis* Ostenf., *Juncus planifolius* var. *tenellus* Benth., *Juncus xantholepis* Steud (COL, 2014). Common name (English): broad-leaved rush, broad-leaf rush, grass-leaved rush.
3	If not a single taxonomic entity, can it be redefined? (if necessary use the response box to re-define the organism and carry on)	N/A	
4	Describe the organism.	-	*Juncus planifolius* is a shortly rhizomatous tufted perennial. Stems are erect and up to 30cm in length (Stace, 1997). Its leaves are 2-8mm wide, flat, basal, and not sharply pointed (Stace, 1997). Its flower head is similar to that of wood rush (*Luzula* spp.), and is small in size (Stace, 1997, 2002). The flowers of *J. planifolius* are greenish, brownish or membranous, and the seed capsules produce many seeds (Stace, 1997; Webb and Scannell, 1983).
5	Does a relevant earlier risk assessment exist? (give details of any previous risk assessment for Ireland)	YES	In Ireland, a preliminary risk assessment was previously carried out. This was a prioritisation risk assessment as part of the Risk Analysis and Prioritisation for Invasive and Non-native Species in Ireland and Northern Ireland (ISI, 2012). It designated *Juncus planifolius* as a “low risk” invasive species.

Stage 1 - Organism Information *The aim of this section is to gather basic information about the organism.*			
N	**QUESTION**	**RESPONSE**	**COMMENT**
6	If there is an earlier Risk Assessment is it still entirely valid, or only partly valid?	PARTIAL	Only a preliminary risk assessment was previously conducted in Ireland (refer to Question 5)
7	Where is the organism native?		The species is native to South Western Australia, New Zealand and South America (Chile, Argentina and Juan Fernández Island) (Stace, 1997, 2002).
8	What is the current global distribution of the organism (excluding Ireland)?		The distributional range of *J. planifolius* constitutes a complex pattern of disjunctions (Balslev, 1980; Fig. 1). It occupies the southern hemisphere, where there is a trans-Pacific disjunction from Australia and New Zealand on one side of the Pacific to the west coast of southern South America on the other (Balslev, 1980). This distribution is interpreted as a result of geological events involving the disruption of a former continuous distribution. The southern hemisphere populations of *J. planifolius* grow in undisturbed habitats. This situation, together with the fact that it is widespread in this area, suggests that it is an old and natural element of the floras of those regions (Balslev, 1980). It occupies the northern hemisphere, which includes remote and isolated localities in Hawaii, Oregon, California and Ireland (Balslev, 1980). The occurrence and distribution of *J. planifolius* in the northern hemisphere is different to that in the southern hemisphere. In Hawaii the species was collected as early as 1930 and reported in the literature to be growing along trails and in other disturbed areas by 1944 (Fagerlund and Mitchell, 1944). On the 31st of July 1971 in the course of field work in the Carna area, specimens of this rush were collected, on a track by the south side of Lough Truscan, West Galway; this was the first gathering of the plant in Ireland (Scannell, 1973). Balslev (1980) identified *J. plantifolius* from unnamed *Juncus* material collected in Coos County, Oregon, America in 1980. The known distribution in the northern hemisphere is of a random pattern, and of which no counterparts are known. An explanation involving a random event, such as long distance dispersal, seems preferable (Balslev, 1980). Several agents for long distance dispersal have been speculated, most commonly man and birds have been proposed as agents (Balslev, 1980).

Stage 1 - Organism Information *The aim of this section is to gather basic information about the organism.*			
N	**QUESTION**	**RESPONSE**	**COMMENT**
			 **Figure 1.** Native and introduced range of *Juncus planifolius* (taken from Balslev, 1980). Dots represent the known distribution as indicated in the literature to 1980.
9	What is the current distribution of the organism in Ireland?	-	First found on the south side of Lough Truscan, southeast of Carna, Co. Galway in 1971 (Scannell, 1973). Well established and locally frequent on Carna-Glinsk peninsula, but has scarcely spread beyond this restricted region of Connemara, Co. Galway (Reynolds, 2002; Scannell, 1973). Stace (2002) report *J. planifolius* to be present in 4 10km squares up to 1999. Thirty-five records of plant covering 8 10km^2 are verified in Ireland by the National Biodiversity Data Centre; (Figure 2; National Biodiversity Data Centre, 2014). The localised range of the species has in the years 1999 to present had a twofold increase.

Stage 1 - Organism Information *The aim of this section is to gather basic information about the organism.*			
N	**QUESTION**	**RESPONSE**	**COMMENT**
			 **Figure 2.** Map showing the verified records for *Juncus planifolius* (broad-leaved rush) per 10km^2 in Ireland. Colour scale bar slows density of records per 10km (National Biodiversity Data Centre, 2014).
10	Is the organism known to be invasive anywhere in the world?	YES	The species is listed as invasive in parts of the U.S.A (CISEH, 2010). *Juncus planifolius* may have the potential to be invasive in Ireland (DAISIE, 2014; National Biodiversity Data Centre, 2014). The establishment and spread of this perennial herb, which grows in dense tufts, may result in competition for space with native flora occurring in damp habitats, peaty and mineral soils, by streams, on lake shores and marshy meadows (ISI, 2012). Such competition for space may result in the displacement of native flora and ultimately cause changes to habitat composition and structure.

Stage 2 - Detailed assessment: Section A - Entry

This section evaluates the probability of entry of an organism into Ireland. For organisms which are already present, only complete the entry section for currently active pathways of entry and potential future pathways. The entry section need not be completed for pathways which have allowed an organism to enter in the past but are no longer active.

N	QUESTION	RESPONSE	CONFIDENCE	JUSTIFICATION
1.01	How many active/future pathways are relevant to the potential entry of this organism (n/a, very few, few, moderate number, many or very many)?	UNKNOWN	HIGH	The mode of introduction is unknown (National Biodiversity Data Centre, 2014; Reynolds, 2002; Stace, 2002)
1.02	List significant pathways through which the organism could enter. Where possible give detail about the specific origins and end points of the pathways.	1. Contaminate clothing/footwear	MEDIUM	The majority of non-native plants most often reach the island of Ireland via the horticultural trade, however *J. planifolius* is not known to be traded i.e. not available commercially (de Lange, 2006; Scannell, 1973). *J. planifolius* occurrence in West Galway is not easily explained as the nearest native occurrence of the plant is at Valdivia, Chile, 8000 miles to the west at 40° South latitude (Scannell, 1973). The known distribution in the northern hemisphere is of a random pattern, and of which no counterparts are known. An explanation involving a random event, such as long distance dispersal, seems preferable (Balslev, 1980). Several agents for long distance dispersal have been speculated, most commonly man and birds have been proposed as agents (Balslev, 1980; Scannell, 1973). Here contaminate clothing/footwear is speculated as a possible pathway of introduction. With increased globalisation and migration there is an increase in the movement of humans around the world. A traveller returning to or visiting Ireland who has in the recent past also visited the native or introduced range of *J. planifolius* may have seed contaminated clothing/footwear. This random event likely represents an historic pathway of introduction and possibly an active future pathway of introduction.

Pathway 1 – Horticultural trade				
N	**QUESTION**	**RESPONSE**	**CONFIDENCE**	**JUSTIFICATION**
1.03	Is entry along this pathway intentional (e.g. the organism is imported for trade) or accidental (e.g. the organism is a contaminant of imported goods)?	ACCIDENTAL	HIGH	Entry of the species along this suggested pathway is accidental.
1.04	How likely is it that large numbers of the organism will travel along this pathway from the point(s) of origin over the course of one year?	VERY UNLIKELY	MEDIUM	Entry of the plant along this pathway would be dependent on a traveller visiting an area where *J. planifolius* is growing and hiking through such habitat in order for clothing/footwear to be contaminated with seed. The traveller would then have to, wearing the unwashed gear, hike through the Irish landscape. This is an extremely random event and it is very unlikely for numbers of seed to be high. Such an event, however rare in occurrence, does highlight the need to monitor humans and their travel history at points of entry into the country. Based off an individual's travel history further questions relating to recreational interests (e.g. hiking) and profession (e.g. farm/land manager) may warrant an examination of the individual's belongings at points of entry.
1.05	How likely is the organism to enter Ireland undetected or without the knowledge of relevant competent authorities?	VERY LIKELY	HIGH	It is very likely that the species could enter Ireland undetected and without the knowledge of the relevant authority as seed contaminate of a traveler's clothing or footwear. Successful introduction(s) have taken place without the knowledge of the competent authorities which may have been as a result of contaminate clothing/footwear.
1.06	How likely is the organism to survive during passage along the pathway?	MODERATELY LIKELY	MEDIUM	The species is known to have previously establishment via an unknown random event. It is therefore moderately likely for the species to survive during passage as a seed contaminate of clothing/footwear.
1.07	How likely is the organism to arrive during the months of the year appropriate for establishment?	MODERATELY LIKELY	MEDIUM	Establishment of seed would be initially dependent on successful germination but seed is likely to remain viable for several years.
1.08	How likely is the organism to be able to transfer from the pathway to a suitable habitat or host?	MODERATELY LIKELY	MEDIUM	*J. planifolius* is a plant of wetlands and riparian zones, habitat types which the species is moderately likely to encounter and/or be introduced to such suitable habitat within the Irish landscape (CORINE, 2006; Fossitt, 2000).

Pathway 1 – Horticultural trade				
N	**QUESTION**	**RESPONSE**	**CONFIDENCE**	**JUSTIFICATION**
1.09	Estimate the overall likelihood of entry into Ireland based on this pathway?	UNLIKELY	MEDIUM	As *J. planifolius* is not a traded horticultural plant, entry is considered dependent on a random event. An explanation involving a random event, such as long distance dispersal, seems preferable (Balslev, 1980). Here contaminate clothing/footwear is speculated as a possible pathway of introduction. With increased globalisation and migration there is an increase in the movement of humans around the world, allowing future entry of *J. planifolius* via the suggested pathway of contaminate clothing/footwear to be considered as moderately likely.
1.10	Do other pathways need to be considered?	UNSURE	MEDIUM	It may be likely that other pathways of introduction need to be considered, but these pathways are currently unknown or unnamed.

Overall likelihood				
N	**QUESTION**	**RESPONSE**	**CONFIDENCE**	**JUSTIFICATION**
1.11	Estimate the overall likelihood of entry into Ireland based on all pathways (comment on the key issues that lead to this conclusion).	UNLIKELY	MEDIUM	Refer to Question 1.09

Stage 2 - Detailed assessment: Section B – Establishment

This section evaluates the probability of establishment of an organism within Ireland. For organisms which are already well established in Ireland there is no need to complete this section - move straight to the Spread section.

N	QUESTION	RESPONSE	CONFIDENCE	JUSTIFICATION
2.01	Is the organism well established in Ireland (if there is any uncertainty answer 'unsure')	NO	HIGH	The species is established and locally frequent in a restricted region of South Connemara, Co. Galway (refer to Question 9, Figure 1; Preston *et al*, 2002). It is present in 8 of the ~1018 10 km squares which constitute the country (National Biodiversity Data Centre, 2014; Stace 2002); it could not, therefore, be described as well established.
2.02	How likely is it that the organism will be able to establish in Ireland based on the similarity between local climatic conditions and the organism's current global distribution?	LIKELY	HIGH	Although the global distribution of *J. planifolius* is disjunct (refer to Question 8), both its native and introduced range are lie within temperate zones. The plants native range falls in the south temperate zone (60°S) and its introduced range falls in the north temperate zone (30°N). The species global range, therefore, includes climatic conditions comparable with Ireland; a temperate oceanic climate which is mild, moist and changeable, with abundant rainfall and lack of temperature extremes (Keane and Collins, 2004).
2.03	How likely is it that the organism will be able to establish in Ireland based on the similarity between other local abiotic conditions and the organism's current global distribution?	LIKELY	HIGH	Grows well in peaty, mineral soils, by streams, lakeshores and marshy meadows, indicative of a preference for damp, wet conditions. (ISI, 2012). It is likely for the plant to encounter peaty, mineral soils under wet conditions in Ireland.
2.04	How likely is the organism to encounter habitats necessary for the survival, development and multiplication of the organism in Ireland?	MODERATELY LIKELY	HIGH	*J. planifolius* is a plant of wetlands and riparian zones habitats types which the species is moderately likely to encounter and/or be introduced to such suitable habitat within the Irish landscape (CORINE, 2006; Fossitt, 2000).
2.05	How likely is it that establishment will occur despite competition from existing species in Ireland?	LIKELY	LOW	As *J. planifolius* has established and is locally frequent in a restricted region of South Connemara, Co. Galway, it is likely that competition does not play a significant role in preventing growth.
2.06	How likely is it that establishment will occur despite predators, parasites or pathogens already present in Ireland?	LIKELY	MEDIUM	There are no known predators or pathogens to the species in Ireland.
2.07	How likely is it that establishment will occur despite existing management practices?	LIKELY	MEDIUM	There are no existing management practices for the control of *J. planifolius* in Ireland. If there is a future need to control the plant, general management of *Juncus* species can be drawn upon – refer to Question 2.09.

Stage 2 - Detailed assessment: Section B – Establishment

This section evaluates the probability of establishment of an organism within Ireland. For organisms which are already well established in Ireland there is no need to complete this section - move straight to the Spread section.

N	QUESTION	RESPONSE	CONFIDENCE	JUSTIFICATION
2.08	How likely is it that management practices in Ireland will facilitate the establishment of the organism?	LIKELY	MEDIUM	*Juncus planifolius* grows in the wettest hollows of the Carna landscape. Turf-cutting, drain digging and other activities that open the soil surface may well increase the opportunity for establishment of the species.
2.09	How likely is it that the biological characteristics of the organism would allow it to survive eradication campaigns in Ireland?	MODERATELY LIKELY	MEDIUM	*Juncus* spp. have been controlled in the past by drainage, mowing and herbicide application and eradication can be achieved when all three approaches are applied at the correct times of the year (ISI, 2012). However, *J. planifolius* seed, stored in the seed bank, and rhizome parts, which have the ability to give rise to a new plant, may permit re-establishment. Growing in some of the wettest bog areas and amongst the roots of dense native vegetation means that access during control operation may be harder, allowing plant fragments to survive.
2.10	How likely is it that the biological characteristics of the organism will facilitate its establishment?	LIKELY	MEDIUM	*Juncus planifolius* is a tufted plant and forms dense stands in wet areas of the Carna peninsula. These are readily spotted at a distance by their reddish-brown colour. It seems capable of forming dense mono-specific stands to the detriment of native species. Reproductive traits of *J. planifolius* may also facilitate establishment. The plant reproduces sexually and has a high seed production (ISI, 2012). It also reproduces vegetatively, via rhizomes (ISI, 2012).
2.11	How likely is it that the organism's capacity to spread will facilitate its establishment?	UNLIKELY	MEDIUM	In Ireland the species has been restricted to the Carna-Glinsk peninsula, Connemara, Co. Galway since first discovered, and side from becoming more frequent locally it has shown little signs of expanding beyond this range (Reynolds, 2002; Scannell, 1983). This suggests that the plant is slow to spread or perhaps more likely it is restricted by the limited availability of favored/suitable habitat. Refer to Question 3.02 for further details.
2.12	How likely is it that the organism's adaptability will facilitate its establishment?	UNLIKELY	HIGH	*J. planifolius* is not environmentally adaptive i.e. it does not occur over a range of habitats, climates or abiotic conditions (refer to Question 2.02, 2.03 and 2.04).
2.13	How likely is it that the organism could establish despite low genetic diversity in the founder population?	LIKELY	MEDIUM	Assuming that the original introduction event involved a single, or very small number of plants or seeds, it is safe to assume that low genetic diversity in the founder population is unlikely to prevent its ongoing establishment.

Stage 2 - Detailed assessment: Section B – Establishment

This section evaluates the probability of establishment of an organism within Ireland. For organisms which are already well established in Ireland there is no need to complete this section - move straight to the Spread section.

N	QUESTION	RESPONSE	CONFIDENCE	JUSTIFICATION
2.14	Based on the history of invasion by this organism elsewhere in the world, how likely is it to establish in Ireland? If possible, specify the instances of invasion elsewhere in the justification box	LIKELY	HIGH	Refer to Question 8 for history of invasion.
2.15	If the organism does not establish, then how likely is it that transient populations will continue to occur?	UNLIKELY	MEDIUM	The species is established and locally frequent on Carna-Glinsk peninsula, Connemara, Co. Galway and to the authors knowledge there are no reports of short-lived individuals or populations.
2.16	Estimate the overall likelihood of establishment. Mention any key issues in the comments box	MODERATELY LIKELY	MEDIUM	*Juncus planifolius* is already established in Ireland, but presently could not be described as well established i.e. widespread. It is locally frequent on Carna-Glinsk peninsula, Connemara, Co. Galway (Reynolds, 2002; Scannell, 1973). Suitable climatic and abiotic conditions for establishment exist in Ireland. The plants ability to reproduce sexually and vegetatively may aid establishment and hinder any future eradication plans (ISI, 2012). Further establishment of *J. planifolius* beyond its current range in Ireland will likely be restricted by the plants requirement for wet habitat (ISI, 2012).

Stage 2 - Detailed assessment: Section C - Spread

This section evaluates the probability of spread of an organism within Ireland. Spread is defined as the expansion of the geographical distribution of an organism within the risk assessment area.

N	QUESTION	RESPONSE	CONFIDENCE	JUSTIFICATION
3.01	What area (given in % or 10km squares) in Ireland could the organism establish (0% - 10%, 11% - 33%, 34% - 67%, 68% - 90% or 91% - 100%)?	11% - 33%	MEDIUM	*J. planifolius* is a plant of wetlands and riparian zones, growing well in peaty, mineral soils, by streams, lakeshores and marshy meadows (ISI, 2012; Reynolds, 2002). With references to the CORINE land cover data *J. planifolius* has the potential to inhabit 11%-33% of the Irish land surface: inland marshes (0.23%), peat bogs (15.37%), salt marshes (0.07%) and stream courses (0.11%).
3.02	How important is the expected spread of this organism in Ireland by natural means (minimal, minor, moderate, major or massive)?	MODERATE	MEDIUM	The very small seed size suggests that *J. planifolius* may be dispersed by wind, water or animals. Other *Juncus* spp. can pass throught the gut of ungulates, germinating from the dung (Cosyns, 2004) but information in an Irish context is absent. The free movement of sheep on commonage areas may be an important vector for the species. In Ireland the species has been restricted to the Carna-Glinsk peninsula, Connemara, Co. Galway since first discovered, and aside from becoming more frequent locally it has shown little signs of expanding beyond this range (ISI, 2012; Reynolds, 2002; Scannell, 1983). A delicate balance of land usage practices, notably turf cutting as a means to open up new habitat, and sheep grazing as a vector of seeds may be significant in the long-distance dispersal of the species. Localised dispersal is likely underpinned by vegetative spread i.e. the growth of tufts.
3.03	How important is the expected spread of this organism in Ireland by human assistance (minimal, minor, moderate, major or massive)?	MINIMAL	MEDIUM	The pathway of *J. planifolius* introduction is unknown and the present assessment suggests contaminate clothing/footwear as a likely means of entry. Human vectors of spread within the country may also be contaminate clothing/footwear or possibly, but less likely, carelessly disposed discards of the plant from land management, mostly likely land improvement.
3.04	Within Ireland, how difficult would it be to contain the organism (minimal, minor, moderate, major or massive)?	MINIMAL	HIGH	There would be minimal difficultly in containing the plant. The species has spread locally and it is uncertain if the species will expand beyond the region it currently occupies (ISI, 2012).
3.05	What proportion (%) of the area in Ireland suitable for establishment, if any, has already been colonised by the organism?	0%-10%	HIGH	With refer to Question 9, the distribution of *J. planifolius* in Ireland, the proportion of the area suitable for establishment that has already been colonised is likely less than 0.5%
3.06	What proportion of the area in Ireland suitable for establishment, if any, do you expect to have been invaded by the organism five years from now (including any current presence)?	0%-10%	MEDIUM	Stace (2002) reported *J. planifolius* to be present in 4 10km squares up to 1999. Thirty-five records of plant covering 8 $10km^2$ are verified in Ireland by the National Biodiversity Data Centre; (Figure 2; National Biodiversity Data Centre, 2014). The localised range of the species has in the years 1999 to present had a twofold increase.

Stage 2 - Detailed assessment: Section C - Spread

This section evaluates the probability of spread of an organism within Ireland. Spread is defined as the expansion of the geographical distribution of an organism within the risk assessment area.

N	QUESTION	RESPONSE	CONFIDENCE	JUSTIFICATION
				The species has, therefore, spread locally, but it is uncertain if the species will expand beyond the region it currently occupies (ISI, 2012). It would therefore not be expected for the species to spread to more than 0%-10% of land cover in the next five years.
3.07	What other timeframe would be appropriate to estimate any significant further spread of the organism (10, 20, 40, 80 or 160 years)? Please comment on why this timeframe is chosen.	20	MEDIUM	Based on the knowledge of spread to-date (refer to Questions 3.05 and 3.06), it would be appropriate to monitor the species for appearance in other regions of west Galway.
3.08	In this timeframe, what proportion of the area (including any currently occupied areas) is likely to have been invaded by this organism?	0%-10%	MEDIUM	Irrespective of a timeframe, the limited capacity for the existing population of *J. planifolius* to spread to-date suggests that the plant will likely never occupy more than 0%-10% of the Irish land cover.
3.09	Based on the answers to questions on the potential for establishment and spread in Ireland, define the area endangered by the organism. Be as specific as possible. If available, provide a map showing the area most likely to be endangered.	-	MEDIUM	Wetlands and riparian zones are most at risk to invasion by the species (ISI, 2012; Reynolds, 2002). The species has the potential to threaten the conservation value and objectives at such sites.
3.10	Estimate the overall potential for future spread for this organism in (very slowly, slowly, moderately, rapidly or very rapidly). Use the justification box to indicate any key issues.	VERY SLOWLY	MEDIUM	Stace (2002) reported *J. planifolius* to be present in 4 10km squares up to 1999. Thirty-five records of plant covering 8 $10km^2$ are verified in Ireland by the National Biodiversity Data Centre; (Figure 2; National Biodiversity Data Centre, 2014). The localised range of the species has in the years 1999 to present had a twofold increase. Localised dispersal is likely underpinned by vegetative spread i.e. the growth of tufts. This suggests that the plant is very slow to spread long distance via natural and (potential) human vectors in Ireland. Although there is a significant percentage of potentially suitable habitat for *J. planifolius* to inhabit, further spread of the plant beyond Carna-Glinsk peninsula, Connemara, Co. Galway is likely limited by a combination of poor long distance dispersal capacity and perhaps also a lack of extended suitable habitat, with a favoured microclimate, in the adjoining area of the plant's current range.

Stage 2 - Detailed assessment: Section D - Impact

This section evaluates the probability of impact of an organism within Ireland.

N	QUESTION	RESPONSE	CONFIDENCE	JUSTIFICATION
4.01	How great is the economic loss caused by the organism within its global distribution (excluding Ireland), including the cost of any current management?	N/A	HIGH	There is no knowledge of any global economic costs incurred to-date.
4.02	How great has the economic cost of the organism been in Ireland from the time of introduction to the present? Exclude any costs associated with managing the organism from your answer.	N/A	HIGH	There is no knowledge of any economic costs incurred to-date in Ireland.
4.03	How great is the economic cost of the organism likely to be in the future in Ireland? Exclude any costs associated with managing the organism from your answer.	N/A	HIGH	If any economic costs where to be incurred they are likely to only be associated with management of the species.
4.04	How great have the economic costs of managing this organism been in Ireland from the time of introduction to the present?	N/A	HIGH	There is no knowledge of any economic costs incurred to-date in Ireland.
4.05	How great is the economic cost of managing this organism likely to be in the future in Ireland?	MINOR	MEDIUM	Economic cost would only arise if the species was to become subject to control measures. The species has such a localised and restricted range that any concerted effort to control/eradication the plant likely to result in minor management costs.
4.06	How important is environmental harm caused by the organism within its global distribution?	MINOR	MEDIUM	The species is listed as invasive in parts of the U.S.A (CISEH, 2010). *Juncus planifolius* may have the potential to be invasive in Ireland (DAISIE, 2014; National Biodiversity Data Centre, 2014). The establishment and spread of this perennial herb, which grows in dense tufts, may result in competition for space with native flora occurring in damp habitats, peaty and mineral soils, by streams, on lake shores and marshy meadows (ISI, 2012). Such competition for space may result in the displacement of native flora and ultimately cause changes to habitat composition and structure.
4.07	How important has the impact of the organism on biodiversity* been in Ireland from the time of introduction to the present? *e.g. decline in native species, changes in community structure, hybridisation	N/A	MEDIUM	In its current state *J. planifolius* it is not a threat to biodiversity or ecosystem functioning (ISI, 2012).

Stage 2 - Detailed assessment: Section D - Impact *This section evaluates the probability of impact of an organism within Ireland.*				
N	**QUESTION**	**RESPONSE**	**CONFIDENCE**	**JUSTIFICATION**
4.08	How important is the impact of the organism on biodiversity likely to be in the future in Ireland?	MINOR	MEDIUM	If *J. planifolius* begins to expand in range it could cause problems in nearby ecologically important areas (ISI, 2012).
4.09	How important has alteration of ecosystem function* caused by the organism been in Ireland from the time of introduction to the present? *e.g. habitat change, nutrient cycling, trophic interactions	N/A	MEDIUM	Refer to Question 4.07
4.10	How important is alteration of ecosystem function caused by the organism likely to be in Ireland in the future?	MINOR	MEDIUM	Refer to Question 4.08
4.11	How important has decline in conservation status* caused by the organism been in Ireland from the time of introduction to the present? *e.g. sites of nature conservation value, WFD classification, etc.	N/A	MEDIUM	In its current state *J. planifolius* it is not reported to be impacting upon the conservation status of protected sites (ISI, 2012).
4.12	How important is decline in conservation status caused by the organism likely to be in the future in Ireland?	MINOR	MEDIUM	If *J. planifolius* begins to expand in range it could cause problems in nearby ecologically important areas (ISI, 2012).
4.13	How important is social or human health harm (not directly included in economic and environmental categories) caused by the organism within its global distribution?	N/A	HIGH	There is no knowledge of any social or human health harm to-date.
4.14	How important is social or human health harm (not directly included in economic and environmental categories) caused by the organism within Ireland?	N/A	HIGH	There is no knowledge of any social or human health harm to-date.
4.15	How important is it that genetic traits of the organism could be carried to other organisms / species, modifying their genetic nature and making their economic, environmental or social effects more serious?	MINIMAL	HIGH	No hybrids with native Juncus species have been reported. J. planifolius is the only member of *Juncus* sect. *Graminifolii* found in Ireland.

Stage 2 - Detailed assessment: Section D - Impact *This section evaluates the probability of impact of an organism within Ireland.*				
N	**QUESTION**	**RESPONSE**	**CONFIDENCE**	**JUSTIFICATION**
4.16	How important is the impact of the organism as food, a host, a symbiont or a vector for other damaging organisms (e.g. diseases)?	N/A	MEDIUM	There are no reports of *J. planifolius* as a host, a symbiont or a vector for other damaging organisms.
4.17	How important might other impacts not already covered by previous questions be resulting from introduction of the organism? Specify in the justification box.	N/A	HIGH	We are not aware of any other impacts the introduction of this species would have.
4.18	How important are the expected impacts of the organism despite any natural control by other organisms, such as predators, parasites or pathogens that may already be present in Ireland?	MINOR	MEDIUM	There are no known predators or pathogens to the species in Ireland.
4.19	Indicate any parts of where economic, environmental and social impacts are particularly likely to occur. Provide as much detail as possible, where possible include a map showing vulnerable areas.	-	MEDIUM	Potential of the plant to be a minor economic and environmental problem of wetland and riparian zone management and conservation sites.
4.20	Estimate the overall potential impact of this organism in Ireland. Use the justification box to indicate any key issues.	MINOR	MEDIUM	On a global and national level there are no reports of existing economic, environmental or social impacts of *J. planifolius*. If any economic costs where to be incurred they are likely to only be associated with any future management of the species (i.e. control). *Juncus planifolius* may have the potential to be invasive in Ireland (DAISIE, 2014; National Biodiversity Data Centre, 2014). It may pose a threat to biodiversity where the plant forms dense tufts resulting in competition for space with native flora occurring in damp habitats, peaty and mineral soils, by streams, on lake shores and marshy meadows (ISI, 2012). Such competition for space may result in the displacement of native flora and ultimately cause changes to habitat composition and structure.

Stage 2 - Detailed assessment: Section E - Conclusion

This section requires the assessor to provide a score for the overall risk posed by an organism, taking into account previous answers to entry, establishment, spread and impact questions.

N	QUESTION	RESPONSE	CONFIDENCE	JUSTIFICATION
5.01	Estimate the overall risk of this organism in Ireland. Noting answers given in 1.11, 2.16, 3.10 & 4.20	MINOR	MEDIUM	As *J. planifolius* is not a traded horticultural plant, entry is considered dependent on a random event. An explanation involving a random event, such as long distance dispersal, seems preferable (Balslev, 1980). Here contaminate clothing/footwear is speculated as a possible pathway of introduction. With increased globalisation and migration there is an increase in the movement of humans around the world, allowing future entry of *J. planifolius* via the suggested pathway of contaminate clothing/footwear to be considered as moderately likely. *Juncus planifolius* is already established in Ireland, but presently could not be described as well established i.e. widespread. It is locally frequent on Carna-Glinsk peninsula, Connemara, Co. Galway (Reynolds, 2002; Scannell, 1973). Suitable climatic and abiotic conditions for establishment exist in Ireland. The plants ability to reproduce sexually and vegetatively may aid establishment and hinder any future eradication plans (ISI, 2012). Further establishment of *J. planifolius* beyond its current range in Ireland will likely be restricted by the plants requirement for wet habitat. Stace (2002) reported *J. planifolius* to be present in 4 10km squares up to 1999. Thirty-five records of plant covering 8 10km^2 are verified in Ireland by the National Biodiversity Data Centre; (Figure 2; National Biodiversity Data Centre, 2014). The localised range of the species has in the years 1999 to present had a twofold increase. Localised dispersal is likely underpinned by vegetative spread i.e. the growth of tufts. This suggests that the plant is very slow to spread long distance via natural and (potential) human vectors in Ireland. Although there is a significant percentage of potentially suitable habitat for *J. planifolius* to inhabit, further spread of the plant beyond Carna-Glinsk peninsula, Connemara, Co. Galway is likely limited by a combination of poor long distance dispersal capacity and perhaps also a lack of extended suitable habitat, with a favoured microclimate, in the adjoining area of the plant's current range. On a global and national level there are no reports of existing economic, environmental or social impacts of *J. planifolius*. If any economic costs where to be incurred they are likely to only be associated with any future management of the species (i.e. control). *Juncus planifolius* may have the potential to be invasive in Ireland (DAISIE, 2014; National Biodiversity

Stage 2 - Detailed assessment: Section E - Conclusion

This section requires the assessor to provide a score for the overall risk posed by an organism, taking into account previous answers to entry, establishment, spread and impact questions.

N	QUESTION	RESPONSE	CONFIDENCE	JUSTIFICATION
				Data Centre, 2014). It may pose a threat to biodiversity where the plant forms dense tufts resulting in competition for space with native flora occurring in damp habitats, peaty and mineral soils, by streams, on lake shores and marshy meadows (ISI, 2012). Such competition for space may result in the displacement of native flora and ultimately cause changes to habitat composition and structure.

Stage 2 - Detailed assessment: Section F – Additional questions

This section is used to gather information about the potential effects of climate change on the risk posed by an organism. It is also an opportunity for the risk assessor to highlight high priority research that could help improve the risk assessment.

N	QUESTION	RESPONSE	CONFIDENCE	JUSTIFICATION
6.01	What aspects of climate change, if any, are most likely to affect the risk assessment for this organism?	-	MEDIUM	Future scenarios on climate alteration in Ireland suggest increases in mean temperature, higher winter rainfall and more intense storm events (Sweeney et al., 2003). It is unclear as to what effect such change may have on *J. planifolius*. A moister climate, given the species preference for damp habitat will likely favour establishment and spread.
6.02	What is the likely timeframe for such changes (5, 10, 15, 20, 50 or 100 years)?	5-100	LOW	Any timeframe during which the Irish climate experiences higher rainfall may be significant to the further spread of the species.
6.03	What aspects of the risk assessment are most likely to change as a result of climate change	-	MEDIUM	Climatic changes in Ireland as a result of climate alteration may require for the risk assessment on the invasiveness of *J. planifolius* reconsider establishment and spread and the species associated impacts to the Irish economy, environment and society.
6.04	If there is any research that would significantly strengthen confidence in the risk assessment, please note this here. If more than one research area is provided, please list in order of priority.	-	MEDIUM	An examination into the introduction (i.e. pathway of entry) of *J. planifolius* in Ireland is required.

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