

Impact of Experimental Road-Verge Management on Ground-Dwelling Spider Diversity in Young Sitka Spruce Plantation Forests

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Introduction

Irish Forest Biodiversity Guidelines state 15% of the forest should be left as Areas for Biodiversity Enhancement. These should comprise of 5-10% open spaces, which includes forest roads. The standard forest road-width currently recommended by the Forest Service is 15m, including 5m road surface and a 5m verge either side of the road up to the tree-line. However at this width the tree canopy often overhangs the road-verge shading out vegetation.



Invertebrate diversity is an important component of forest ecosystems and in particular, ground-dwelling spiders play a significant role in forest food webs as they regulate litter invertebrate communities. Additionally they are useful bioindicators in forest ecosystems as they are sensitive to changes in the structural diversity of litter and ground vegetation, taxonomically well-known and are easily sampled.

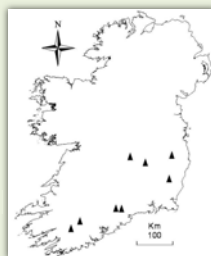
We aimed to examine the potential of open space provided by forest roads to enhance overall plantation biodiversity.

Objectives

- Test the effect of doubling the standard road-width of forest roads from 15m to 30m on active ground-dwelling spider diversity in Sitka spruce plantations
- Examine the diversity value of road verges in comparison to the forest interior
- Investigate the influence of road-verge vegetation on active ground-dwelling spider diversity

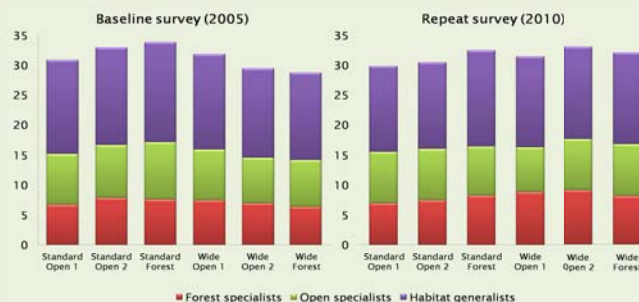
Methods

- Active ground-dwelling spiders were sampled in eight sites across Ireland by pitfall trapping
- Two treatments were used in each site: the "standard" 15m road-width and a "wide" 30m road-width which included a 5m road surface and 10m of road-verge either side
- Spiders were sampled using pitfall traps set in transects from the road-verge into the forest
- Three replicates of each transect position were sampled in each treatment
- Sampling was carried out between May-July totalling 63 consecutive sampling days
- A baseline survey was done at tree establishment in 2005 and a repeat survey was done after five years (2010)

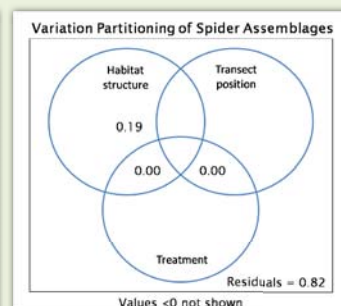
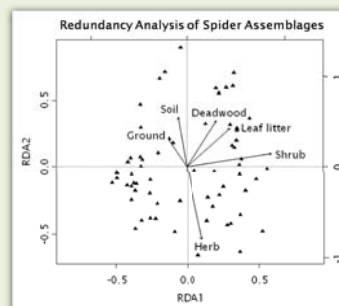


Results

- In the first five years of the forest cycle there is no effect of treatment (PERMANOVA $F_{1,7} = 1.119$, $P = 0.311$) or plot position (PERMANOVA $F_{1,7} = 0.387$, $P = 1.000$) on spider composition or species richness
- A mixture of forest specialist, open specialist and habitat generalist spider species were found



- Ten species were classed as endangered or vulnerable and these species require open, well-vegetated areas
- Both the road-verge and forest interior had well-developed vegetation
- Habitat structure explained 19% of the variation in species composition of the road-verges (RDA, $F_{6,63} = 3.423$, $P = 0.001$)
- Shrub and herb vegetation were the two most influential variables



Redundancy Analysis results:
Influence of Habitat Variables on Spider Assemblages

Percentage cover	$F_{1,63}$	P
Shrub vegetation	7.8280	< 2.2 ⁻¹⁶
Herb vegetation	3.8708	< 2.2 ⁻¹⁶
Deadwood	2.8215	0.0004
Leaf litter	2.4169	0.001
Bare soil	1.8186	0.021
Ground vegetation	1.7839	0.022

Conclusions

- This data is an important baseline of information against which future surveys of the effect of road-width treatment and the diversity of road-verges can be measured
- Repeat surveys of this experiment are recommended for all stages of the forest cycle in order to understand how changes in spider diversity are affected by the habitat in plantation forest road-verges
- The importance of investigating the biodiversity of young plantation forests is particularly relevant in countries undertaking large-scale afforestation programmes such as Ireland and the UK