Gorse (Ulex europaeus) infestations in Hawaii and New Zealand display similar patterns of resource exploitation from altered landscapes.

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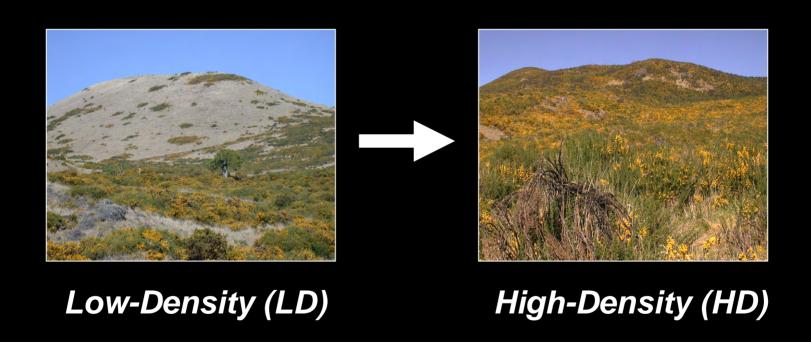
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Abstract

Gorse is a woody legume shrub that is endemic to Western Europe and the Mediterranean, but is also a major cosmopolitan weed with infestations existing in ten other countries through out the globe. To determine how gorse infestations are influential in different geographical locations, separate field analyses were conducted on Mauna Kea, Hawaii and Bank's Peninsula, New Zealand. At both sites, three experimental units were identified and consisted of a high-density gorse population (HD) zone and an adjacent low-density gorse population (LD) zone. Furthermore, the LD zones in Hawaii were areas with young pioneer gorse individuals in early succession, while the LD zones of New Zealand were former infestations in late succession. Soil, plant, and bacterial samples were collected from all zones at both locations. Soil nutrient status was the best indicator of gorse impacting the landscape. Soil pH was significantly lower in the HD zones for both sites. Concentrations of Ca and Mg were also significantly higher in the LD zones for both sites, while AI concentrations were significantly higher in the HD zones. Plant AI concentration was significantly higher only in the LD zone in New Zealand, but not in Hawaii. This was the only significant difference for all tissue nutrients for both sites. This suggests that changes to the soil are dependent on gorse plant densities (i.e. infestation) and reversion of soil nutritional status is a successional trait of the landscape. This work also suggests that Al accumulation by gorse in late succession may be an indicator of decline. Bradyrhizobium isolates from Hawaii and New Zealand do not share the same Box-PCR marker profiles, while gorse and koa (Acacia koa) Bradyrhizobium isolates do. This indicates that gorse does not require specific host-symbiont relationships for symbiosis and is compatible with a wide range of indigenous Bradyrhizobium for effective nitrogen fixation. Regardless of the geographic location, nutrition and symbiosis are important factors to regulate in preventative and responsive control strategies.

Gorse infestations of Mauna Kea, Hawaii



Early succession of pioneer gorse along the infestation perimeter

Monotypic stand of yellow flowering gorse

Gorse infestations in Bank's Peninsula, New Zealand



High-Density (HD)

Low-Density (LD)

Monotypic stand of yellow flowering gorse

Late succession replacement by native species









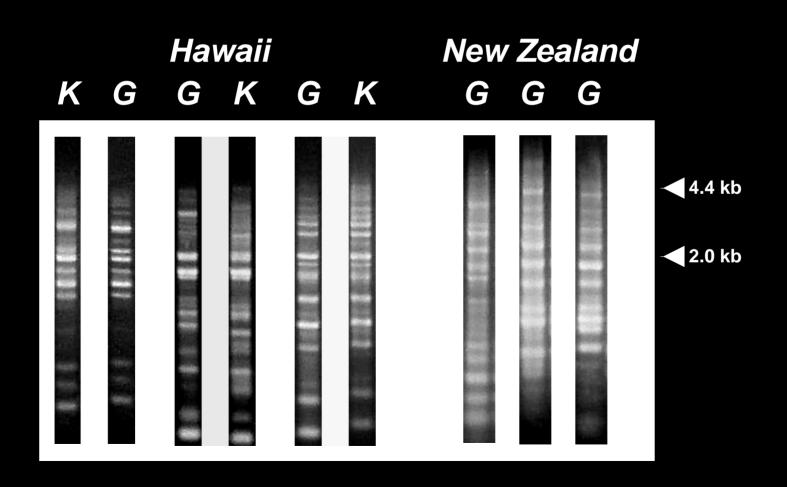
Changes in soil nutrient compositions from low-density gorse to high-density gorse for Hawaii and New Zealand

	Hawaii		New Zealand	
		P-value		P-value
Soil pH	+	0.04	+	0.002
Ca cmol (+) kg-1	+	0.01		0.05
Mg cmol (+) kg-1	+	0.004	+	0.02
AI cmol (+) kg-1		0.03		0.02
(Ca + Mg): AI	+	0.02	+	0.06

Changes in apical stem compositions from low-density gorse to high-density gorse for Hawaii and New Zealand

	Hawaii		New Zealand	
	(LD → HD)	P-value	(LD → HD)	P-value
%N	-	NS	-	NS
Ca mmol kg-1	-	NS	_	NS
Mg mmol kg-1	-	NS	_	NS
AI mmol (+) kg-1	-	NS		0.02
(Ca + Mg): AI	•	NS	-	NS

Matching Box-PCR fingerprint profiles of Bradyrhizobium isolated from gorse (G) and koa (K) in Hawaii and dominant profiles from gorse in New Zealand that do not match the Hawaiian profiles.



Conclusions of gorse as an invasive weed species:

Gorse infestations from different geographical locations, demonstrate consistent patterns of landscape alteration.

These alterations are density dependent traits, with highdensity monotypic stands having a significant impact.

A reduction in gorse infestations will result in a reversion back to the original nutritional status of the soil.

Gorse is a promiscuous host that can nodulate with distinct Bradyrhizobium indigenous to different geographical locations.