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Appendix 3. Examples of biotic variables potentially suitable for assessing the severity of disruption to biotic interactions under Criterion D. From (1).

Variable	Role in ecosystem resilience and function	Example
Species richness (number of species within a taxonomic group per unit area).	Ecological processes decline at an accelerating rate with loss of species (2). Species richness is related indirectly to ecosystem function and resilience through its correlations with functional diversity, redundancy and complementarity.	Response of species diversity of grasses and relative abundance to varying levels of grazing in grassland (3).
Species composition and dominance.	Shifts in dominance and community structure are symptoms of change in ecosystem behaviour and identity.	Shift in diet of top predators (killer whales) due to overfishing effects on seals, caused decline of sea otters reduced predation of kelp-feeding urchins, causing their populations to explode with consequent collapse of giant kelp, structural dominants of the benthos (4).
Abundance of key species (ecosystem engineers, keystone predators and herbivores, dominant competitors, structural dominants, transformer invasive species).	Invasions of certain alien species may alter ecosystem behaviour and identity, and make habitat unsuitable for persistence of some native biota. Transformer alien species are distinguished from benign invasions that do not greatly influence ecosystem function and dynamics	Invasion of crazy ants simplifies forest structure, reduces faunal diversity and native ecosystem engineers (5). Invasion of arid Australian shrublands and grasslands by Buffel Grass makes them more fire prone and less favourable for persistence of native plant species (6, 7).

Functional diversity (number and evenness of types).	High diversity of species functional types (e.g. resource use types, disturbance response types) promotes co-existence through resource partitioning, niche diversification and mutualisms (8). Mechanisms similar to functional complementarity.	High diversity of plant-derived resources sustains composition, diversity and function of soil biota (9), Fire regimes promote coexistence of multiple plant functional types (10).
Functional redundancy (number of taxa per type; within- and cross-scale redundancy; see (8).	Functionally equivalent minor species may substitute for loss or decline of dominants if many species perform similar functional roles (functional redundancy). Low species richness may be associated with low resilience and high risks to ecosystem function under environmental change (3, 8).	Response of bird communities to varying levels of land use intensity (11).
Functional complementarity (dissimilarity between types or species).	Functional complementarity between species (e.g. in resource use, body size, stature, trophic status, phenology) enhances coexistence through niche partitioning and maintenance of ecosystem processes (12).	High functional complementarity within both plant and pollinator assemblages promotes recruitment of more diverse plant communities (13).
Interaction diversity (interaction frequencies and dominance, properties of network matrices).	Interactions shape the organization of ecosystems, mediate evolution and persistence of participating species and influence ecosystem-level functions, e.g. productivity (14).	Overgrazing reduced diversity of pollination interactions (15).
Trophic diversity (number of trophic levels, interactions within levels, food web structure).	Compensatory effects of predation and resource competition maintain coexistence of inferior competitors and prey. Loss or reduction of some interactions (e.g. by overexploitation of	Diverse carnivore assemblages (i.e. varied behaviour traits and densities) promote coexistence of plant species (16), decline of primary prey precipitates diet shifts and

	top predators) may precipitate trophic cascades via competitive elimination or overabundance of generalist predators.	phase shifts (17).
Spatial flux of organisms (rate, timing, frequency and duration of species movements between ecosystems).	Spatial exchanges among local systems in heterogeneous landscapes provide spatial insurance for ecosystem function (18). Exchanges may involve resources, genes or involvement in processes (19).	Herbivorous fish and invertebrates migrate into reefs from sea grass beds and mangroves, reducing algal abundance on reefs and maintaining suitable substrates for larval establishment of corals after disturbance (20).
Structural complexity (e.g. complexity indices, number and cover of vertical strata in forests, reefs, remote sensing indices).	Simplified architecture reduces niche diversity, providing suitable habitats for fewer species, greater exposure to predators or greater competition for resources (due to reduced partitioning).	Structurally complex coral reefs support greater fish diversity (21), structurally complex woodlands support greater bird diversity (22).

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