What we (don’t) know about the effects of habitat loss and fragmentation on felids

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TABLE S1 Search strings for felid species, and the relevant publications on the effects of habitat loss and fragmentation.

Species	Search string	References
Acinonyx jubatus	'Acinonyx jubatus' OR 'hunting leopard' OR 'cheetah'	Reed, 2004
Caracal aurata	'Caracal aurata' OR 'Profelis aurata' OR 'Felis aurata' OR 'African golden cat' OR 'golden cat'	None
Caracal caracal	'Caracal caracal' OR 'Felis caracal' OR 'caracal' OR 'African caracal' OR 'Asian caracal' OR 'desert lynx'	None
Felis chaus	'Felis chaus' OR 'jungle cat' OR 'reed cat' OR 'swamp cat'	None
Felis margarita	'Felis margarita' OR 'sand cat' OR 'sand dune cat'	None
Felis nigripes	'Felis nigripes' OR 'black-footed cat' OR 'small-spotted cat'	Blaum et al., 2007
Felis silvestris	'Felis silvestris' OR 'wildcat'	Virgós, 2001; Virgós et al., 2002; Mata et al., 2005; Ascensão & Mira, 2007; Klar et al., 2008, 2009, 2012; Santos et al., 2008; Meinig & Boye, 2009; Say et al., 2012
Leopardus colocolo	'Leopardus colocolo' OR 'Felis colocolo' OR 'Oncifelis colocolo' OR 'pampas cat' OR 'Chilean pampa cat'	Carvalho et al., 2009; Medina-Vogel, 2010; Moisés Gallas & da Silveira, 2011; Pereira et al., 2011
Leopardus geoffroyi	'Leopardus geoffroyi' OR 'Oncifelis geoffroyi' OR 'Felis geoffroyi' OR 'geoffroy’s cat'	Canepuccia et al., 2008; Andrade-Núñez & Aide, 2010; Medina-Vogel, 2010; Moisés Gallas & da Silveira, 2011;

Species	Search string	References
		Pereira et al., 2011; Lantschner et al., 2012
Leopardus guigna	'Leopardus guigna' OR 'Oncifelis guigna' OR 'Felis guigna' OR 'kodkod' OR 'guiña' OR 'Chilean cat'	Acosta-Jamett et al., 2003; Acosta-Jamett & Simonetti, 2004; Farias & Jaksic, 2011
Leopardus jacobita	'Leopardus jacobita' OR 'Oreailurus jacobita' OR 'Felis jacobita' OR 'Oreailurus jacobitus' OR 'Andean mountain cat' OR 'Andean Cat' OR 'Mountain Cat'	Medina-Vogel, 2010
Leopardus pardalis	'Leopardus pardalis' OR 'Felis pardalis' OR 'ocelot'	Bisbal, 1993; Estrada et al., 1994; Medellin & Equihua, 1998; Chiarello, 1999; Cuarón, 2000; Mora et al., 2000; Jackson et al., 2005; Dillon & Kelly, 2007; Dotta & Verdade, 2007, 2011; Janečka et al., 2007, 2008; Michalski & Peres, 2007; Whiteman et al., 2007; Lyra-Jorge et al., 2008, 2010; Cáceres et al., 2010; Sampaio et al., 2010; Thornton et al., 2011a, 2011b
Leopardus tigrinus	'Leopardus tigrinus' OR 'Felis tigrinus' OR 'oncilla' OR 'little spotted cat' OR 'little tiger cat' OR 'tiger cat'	Bisbal, 1993; Chiarello, 1999; Coelho et al., 2008; Dotta & Verdade, 2011; Moisés Gallas & da Silveira, 2011
Leopardus wiedii	'Leopardus wiedii' OR 'margay' OR 'tree ocelot'	Bisbal, 1993; Estrada et al., 1994; Medellin & Equihua, 1998; Chiarello, 1999; Cuarón, 2000; Andrade-Núñez & Aide, 2010; Dotta & Verdade, 2011; Thornton et al., 2011a, 2011b
Leptailurus serval	'Leptailurus serval' OR 'Caracal serval' OR 'serval'	None
Lynx canadensis	'Lynx canadensis' OR 'canada lynx'	Carroll et al., 2001; Schwartz et al., 2003; Hoving et al., 2005; Bayne et al., 2008; Koehler et al., 2008; Murray et al., 2008; Dunne & Quinn, 2009
Lynx lynx	'Lynx lynx' OR 'Felis lynx' OR 'Eurasian lynx'	Schadt et al., 2002a, b; Kramer-Schadt et al., 2004, 2005,

Species	Search string	References
		2011; Niedziałkowska et al., 2006; Breitenmoser et al., 2007; Zimmermann et al., 2007; Hetherington et al., 2008; Basille et al., 2009; Hepcan et al., 2009; Meinig & Boye, 2009; Schmidt et al., 2009, 2011; Huck et al., 2010; Mortelliti et al., 2010
Lynx pardinus	'Lynx pardinus' OR 'Felis pardinus' OR 'Iberian lynx' OR 'lynx pardinus' OR 'pardel lynx' OR 'Spanish lynx'	Ferreras et al., 1992, 2001, 2004; Rodríguez & Delibes, 1992, 2002, 2003, 2004; Gaona et al., 1998; Palomares et al., 2000; Ferreras, 2001; Palomares, 2001; Fernández et al., 2003; Johnson et al., 2004; Revilla et al., 2004; Revilla & Wiegand, 2008; Santos et al., 2008; Medina-Vogel, 2010; Rodríguez et al., 2011
Lynx rufus	'Lynx rufus' OR 'Felis rufus' OR 'bobcat' OR 'bay lynx'	Lomolino & Perault, 2000; Velázquez et al., 2001; Crooks, 2002; Tigas et al., 2002; Hunter et al., 2003; Riley et al., 2003, 2006; Cain et al., 2003; Hilty & Merenlender, 2004; Reed, 2004; Constible et al., 2006; Hilty et al., 2006; George & Crooks, 2006; Riley, 2006; Millions & Swanson, 2007; Preuss & Gehring, 2007; Markovchick-Nicholls et al., 2008; Tucker et al., 2008; Johnson et al., 2010; Medina-Vogel, 2010; Ordeñana et al., 2010; Roberts et al., 2010; Lee et al., 2012; Linde et al., 2012; Ruell et al., 2012
Neofelis diardi	'Neofelis diardi' OR 'Sunda clouded leopard' OR 'enkuli clouded leopard' OR 'Sunda islands clouded leopard' OR 'Sundaland Clouded Leopard'	None
Neofelis nebulosa	'Neofelis nebulosa' OR 'clouded leopard'	Laidlaw, 2000; Lau et al., 2010
Otocolobus manul	'Otocolobus manul' OR 'Felis manul' OR 'manul' OR	None

Species	Search string	References
	'Pallas's Cat'	
Panthera leo	'Panthera leo' OR 'lion' OR 'African Lion'	Brook et al., 2002; Björklund, 2003; Reed, 2004; Alexander et al., 2010; Schnitzler, 2011; Singh & Gibson, 2011
Panthera onca	'Panthera onca' OR 'jaguar'	Bisbal, 1993; Medellin & Equihua, 1998; Chiarello, 1999; Ortega-Huerta & Medley, 1999; Cuarón, 2000; Michalski & Peres, 2007; Whiteman et al., 2007; McCain & Childs, 2008; Carvalho et al., 2009; Conde et al., 2010; Haag et al., 2010; Sampaio et al., 2010; Colchero et al., 2011; Thornton et al., 2011b; Vynne et al., 2011
Panthera pardus	'Panthera pardus' OR 'Felis pardalis' OR 'leopard'	Fleury & Brown, 1997; Pattanavibool & Dearden, 2002; Johnsingh & Negi, 2003; Ngoprasert et al., 2007; Lau et al., 2010; Svengren & Björklund, 2010; Trisurat et al., 2012
Panthera tigris	'Panthera tigris' OR 'tiger'	Fleury & Brown, 1997; Wikramanayake et al., 1998; Laidlaw, 2000; Lynam et al., 2001, 2006; Kerley et al., 2002; Pattanavibool & Dearden, 2002; Johnsingh & Negi, 2003; Kawanishi et al., 2003; Kinnaird et al., 2003; Linkie et al., 2003; O'Brien et al., 2003; Reed, 2004; Carroll & Miquelle, 2006; Goodrich et al., 2008; Chauvenet et al., 2010; Lau et al., 2010; Loucks et al., 2010; Lynam, 2010; Wibisono & Pusparini, 2010; Mondal & Nagendra, 2011; Tian et al., 2011; Xiaofeng et al., 2011; Trisurat et al., 2012
Panthera uncia	'Panthera uncia' OR 'Uncia uncia' OR 'snow leopard'	Forrest et al., 2012
Pardofelis badia	'Pardofelis badia' OR 'Felis badia' OR 'Catopuma badia' OR 'bay cat' OR 'Bornean bay cat' OR 'Bornean	None

Species	Search string	References
	marbled cat' OR 'Borneo bay cat'	
Pardofelis marmorata	'Pardofelis marmorata' OR 'Felis marmorata' OR 'marbled cat'	Trisurat et al., 2012
Pardofelis temminckii	'Pardofelis temminckii' OR 'Catopuma temminckii' OR 'Felis temmincki' OR 'Asiatic golden cat' OR 'golden cat' OR 'temminck's cat'	Lau et al., 2010
Prionailurus bengalensis	'Prionailurus bengalensis' OR 'Felis bengalensis' OR 'rusty-spotted cat' OR 'leopard cat'	Rhim & Lee, 2007; Izawa et al., 2009; Lau et al., 2010; Trisurat et al., 2012
Prionailurus planiceps	'Prionailurus planiceps' OR 'Felis planiceps' OR 'flat-headed cat' OR 'flat headed cat'	None
Prionailurus rubiginosus	‘Prionailurus rubiginosus’ OR ‘rusty-spotted cat’	None
Prionailurus viverrinus	'Prionailurus viverrinus' OR 'Felis viverrinus' OR 'fishing cat'	None
Puma concolor	'Puma concolor' OR 'Felis concolor puma' OR 'mountain lion' OR 'cougar' OR 'deer tiger' OR 'red tiger'	Beier, 1993, 1995; Bisbal, 1993; Estrada et al., 1994; Smallwood, 1994; Fleury & Brown, 1997; Chiarello, 1999; Cuarón, 2000; Hoctor et al., 2000; Sweanor et al., 2000; Velázquez et al., 2001; Buergelt et al., 2002; Dickson & Beier, 2002; Daily et al., 2003; Ernest et al., 2003; Hunter et al., 2003; Hilty & Merenlender, 2004; Dickson et al., 2005; Hilty et al., 2006; Whiteman et al., 2007; Land et al., 2008; Lyra-Jorge et al., 2008, 2010; Markovchick-Nicholls et al., 2008; Morrison & Boyce, 2009; Burdett et al., 2010; Cáceres et al., 2010; Mazzolli, 2010; Medina-Vogel, 2010; Ordeñana et al., 2010; Sampaio et al., 2010; Castilho et al., 2011; Dotta

Species	Search string	References
		& Verdade, 2011; ; Loxterman, 2011; Miotto et al., 2011; Schwab & Zandbergen, 2011; Thornton et al., 2011b; Vynne et al., 2011; Lantschner et al., 2012
Puma yagouaroundi	'Puma yagouaroundi' OR 'Herpailurus yaguarondi' OR 'Herpailurus yagouaroundi' OR 'jaguarundi'	Bisbal, 1993; Estrada et al., 1994; Medellin & Equihua, 1998; Chiarello, 1999; Cuarón, 2000; Daily et al., 2003; Sampaio et al., 2010; Dotta & Verdade, 2011; Moisés Gallas & da Silveira, 2011; Pereira et al., 2011; Thornton et al., 2011a, 2011b

TABLE S2 Current Red List status of felid species (IUCN, 2011), and knowledge of the effects of habitat loss and fragmentation, based on a review of 162 published scientific articles.

Species	IUCN category[1]	Summary of results
Acinonyx jubatus	VU[2]	None
Caracal aurata	NT[2]	None
Caracal caracal	LC[2]	None
Felis chaus	LC[2]	None
Felis margarita	NT[2]	None
Felis nigripes	VU[2]	Negatively affected by increased shrub cover
Felis silvestris	LC[2,3]	Stable populations in most of its range; negatively affected by human activities & settlement, construction of dams, & roads.
Leopardus colocolo	NT[2]	In Goiás state (Brazil) the fragments of native vegetation are too small to maintain the species; infection by parasites from domestic animals
Leopardus geoffroyi	NT[2]	Grassland are unsuitable, but can use areas of eucalypt plantation; habitat loss as a result of climatic change; infection by parasites from domestic animals
Leopardus guigna	VU[2]	Requires large patches of dense shrub cover far from roads; many metapopulation in Chile are threatened.
Leopardus jacobita	EN[2]	Infection by parasites
Leopardus pardalis	LC[2]	Threats include local loss of genetic diversity, diseases from domestic animals, & road traffic; uses eucalypt & sugar-cane matrix as corridors.
Leopardus tigrinus	VU[2,3]	Can use small patches of high-quality habitat; infection by parasites
Leopardus wiedii	NT[2,3]	Populations are declining; observed more frequently in core areas of fragments
Leptailurus serval	LC[2]	None
Lynx canadensis	LC[2]	Avoids open areas & roads; peripheral populations have lower genetic diversity
Lynx lynx	LC[2]	Distribution is largely fragmented, resulting in a marginalized population, demographically unviable, more susceptible to disease, with low & sub-

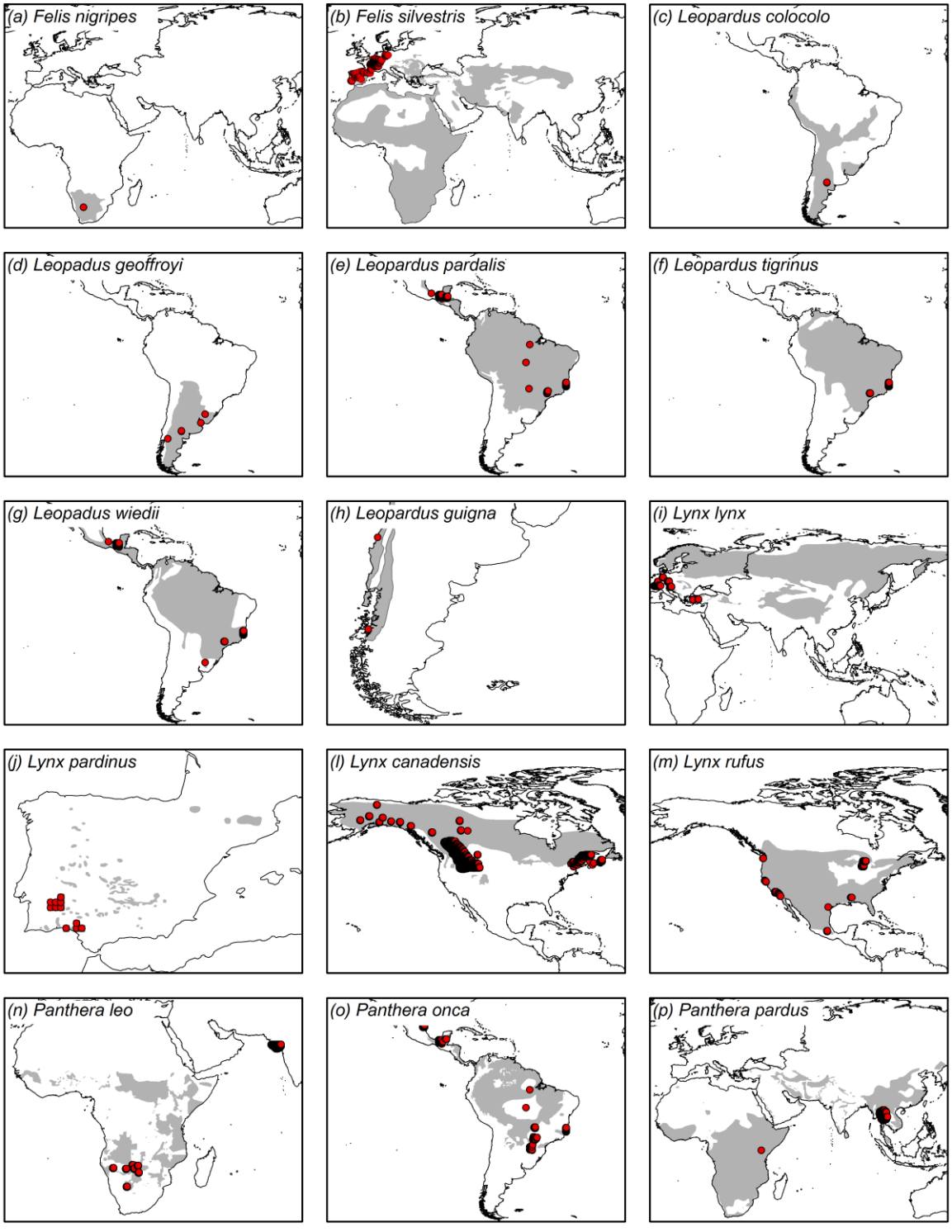
Species	IUCN category[1]	Summary of results
		structured genetic diversity; reconnection of unviable population is difficult because of the small size of adjacent patches & the presence of man-made barriers
Lynx pardinus	CR[2,3]	Restricted to two populations; threats include habitat loss & fragmentation; low genetic variability, leading to inbreeding depression; increased mortality as a result of road kills, trapping, & shooting; & diseases transmitted from domestic animals; populations cannot be reconnected because of barriers formed by urban areas & roads
Lynx rufus	LC[2]	Can cross highways, but this increases mortality rate; uses recreational zones of urban nature reserves but this is less suitable habitat; prone to diseases transmitted by domestic animals; responds positively to increase in patch size & habitat interspersion, but negatively to irregular-shaped patches & increase in edge habitats; populations are genetically structured as a result of barriers in the form of roads but still have high diversity
Neofelis diardi	VU[2]	None
Neofelis nebulosa	VU[2]	Requires large area of habitat
Otocolobus manul	NT[2]	None
Panthera leo	VU[2]	Inbreeding depression & local extinction as a result of habitat loss; high index of infection by parasites
Panthera onca	NT[2]	Low tolerance to habitat loss, fragmentation & anthropogenic land cover; isolated populations in Atlantic Forest & Cerrado biome (Brazil); native vegetation is an important predictor of its occurrence
Panthera pardus	NT[2]	Population subdivided by fragmentation & roads
Panthera tigris	EN[2]	Moderately tolerant of human disturbance but its abundance can be reduced in anthropogenic areas because of its high ecological requirements; populations divided by anthropogenic barriers such as roads, infrastructure & agriculture; unviable populations
Panthera uncia	EN[2]	Approximately 30% of habitat may be lost as a result of future climatic changes

Species	IUCN category[1]	Summary of results
Pardofelis badia	EN[2]	None
Pardofelis marmorata	VU[2]	None
Pardofelis temminckii	NT[2]	None
Prionailurus bengalensis	LC[2]	Moderately tolerant of degraded habitat; threats include habitat loss, competition with introduced species, & road traffic
Prionailurus planiceps	EN[2]	None
Prionailurus rubiginosus	VU[2]	None
Prionailurus viverrinus	EN[2]	None
Puma concolor	LC[2,3]	Has a high environmental plasticity that enables it to use landscapes with some level of anthropogenic influence & to cross areas with roads & bridges; threats include road traffic, sub-structuration of genetic variability among fragments, inbreeding depression, edge effects, & disease transmission from domestic animals
Puma yagouaroundi	LC[2]	Moderately tolerant of anthropogenic land cover & uses edge fragments but mainly prefers habitat of better quality; infection by parasites

[1]LC, Least Concern; NT, Near Threatened; VU, Vulnerable; EN, Endangered; CR, Critically Endangered

[2]Habitat loss and fragmentation is considered a threat to the species.

[3]Road traffic is considered a threat to the species


(a) Felis nigripes
(b) Felis silvestris
(c) Leopardus colocolo
(d) Leopadus geoffroyi
(e) Leopardus pardalis
(f) Leopardus tigrinus
(g) Leopadus wiedii
(h) Leopardus guigna
(i) Lynx lynx
(j) Lynx pardinus
(l) Lynx canadensis
(m) Lynx rufus
(n) Panthera leo
(o) Panthera onca
(p) Panthera pardus

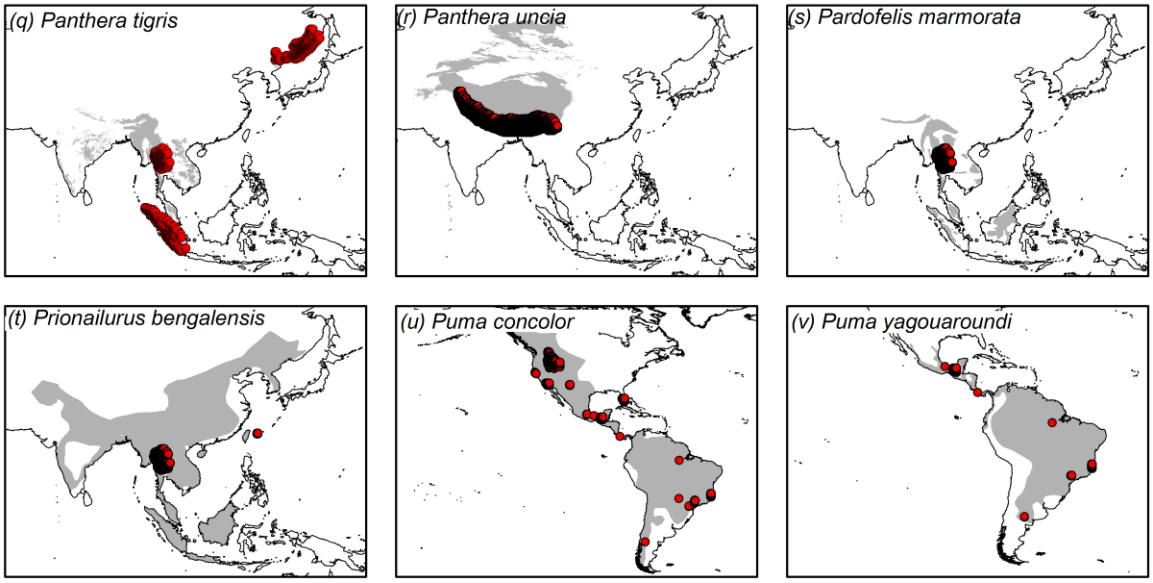


FIG. S1 Distribution of felid species that were the subject of at least one publication on the effects of habitat loss and fragmentation (in grey) and locations where studies were conducted (in red).

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