

Estimates of carnivore densities in a human-dominated agricultural matrix in South Africa

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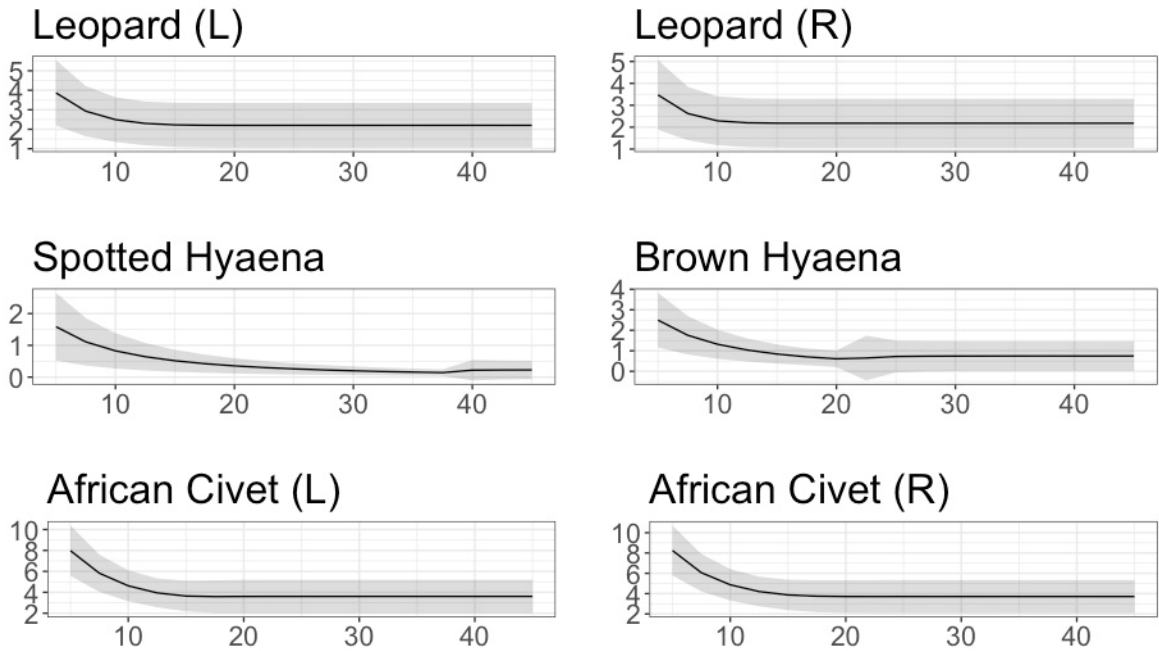
SUPPLEMENTARY TABLE 1 Home range estimates for leopard *Panthera pardus*, spotted hyaena *Crocuta crocuta*, brown hyaena *Parahyaena brunnea*, and African civet *Civettictis civetta* from studies in Africa.

| Species | Location | Home range (km ²) | Source |
|----------------|--|-------------------------------|-------------------------|
| Leopard | Western Soutpansberg, South Africa | 14.00 | Chase Grey, 2011 |
| Leopard | Western Soutpansberg, South Africa | 16.30 | Chase Grey et al., 2013 |
| Leopard | Western Soutpansberg, South Africa | 20.00 | Williams et al., 2017 |
| Leopard | Northern Tuli Game Reserve, Botswana | 21.50 | Steyn & Funston, 2009 |
| Leopard | Northern Tuli Game Reserve, Botswana | 25.90 | Steyn & Funston, 2009 |
| Leopard | Mangwe District, Zimbabwe | 32.00 | Grant, 2012 |
| Leopard | Mangwe District, Zimbabwe | 37.00 | Grant, 2012 |
| Leopard | Northern Tuli Game Reserve, Botswana | 37.20 | Steyn & Funston, 2009 |
| Leopard | North-central farmlands, Namibia | 40.00 | Stein et al., 2011 |
| Leopard | Waterberg Plateau, Namibia | 52.40 | Dickman & Marker, 2005 |
| Leopard | Northern Tuli Game Reserve, Botswana | 63.80 | Steyn & Funston, 2009 |
| Leopard | North-central farmlands, Namibia | 66.00 | Stein et al., 2011 |
| Leopard | Northern Tuli Game Reserve, Botswana | 78.00 | Steyn & Funston, 2009 |
| Leopard | Northern Tuli Game Reserve, Botswana | 86.40 | Steyn & Funston, 2009 |
| Leopard | North-central farmlands, Namibia | 108.00 | Stein et al., 2011 |
| Leopard | Waterberg Plateau, Namibia | 125.20 | Dickman & Marker, 2005 |
| Leopard | Waterberg Plateau, Namibia | 132.60 | Dickman & Marker, 2005 |
| Leopard | Waterberg Plateau, Namibia | 137.30 | Dickman & Marker, 2005 |
| Leopard | Mangwe District, Zimbabwe | 231.00 | Grant, 2012 |
| Leopard | Waterberg Plateau, Namibia | 250.00 | Dickman & Marker, 2005 |
| Leopard | Waterberg Plateau, Namibia | 311.90 | Dickman & Marker, 2005 |
| Leopard | Waterberg Plateau, Namibia | 393.50 | Dickman & Marker, 2005 |
| <i>Mean</i> | | 103.64 | |
| Spotted hyaena | Masai Mara National Reserve, Kenya | 28.90 | Boydston et al., 2003 |
| Spotted hyaena | Kruger National Park, South Africa | 33.70 | Belton et al., 2016 |
| Spotted hyaena | Masai Mara National Reserve, Kenya | 38.70 | Boydston et al., 2003 |
| Spotted hyaena | Masai Mara National Reserve, Kenya | 45.30 | Boydston et al., 2003 |
| Spotted hyaena | Masai Mara National Reserve, Kenya | 46.70 | Boydston et al., 2003 |
| Spotted hyaena | Doispane, South Africa | 47.90 | Belton et al., 2016 |
| Spotted hyaena | Doispane, South Africa | 53.10 | Belton et al., 2016 |
| Spotted hyaena | Serengeti, Tanzania | 55.42 | Hofer & East, 1993 |
| Spotted hyaena | Masai Mara National Reserve, Kenya | 55.60 | Boydston et al., 2003 |
| Spotted hyaena | Masai Mara National Reserve, Kenya | 59.20 | Boydston et al., 2003 |
| Spotted hyaena | Masai Mara National Reserve, Kenya | 60.50 | Boydston et al., 2003 |
| Spotted hyaena | Masai Mara National Reserve, Kenya | 62.70 | Boydston et al., 2003 |
| Spotted hyaena | Masai Mara National Reserve, Kenya | 63.50 | Boydston et al., 2003 |
| Spotted hyaena | Masai Mara National Reserve, Kenya | 63.60 | Boydston et al., 2003 |
| Spotted hyaena | Masai Mara National Reserve, Kenya | 69.50 | Boydston et al., 2003 |
| Spotted hyaena | Masai Mara National Reserve, Kenya | 76.00 | Boydston et al., 2003 |
| Spotted hyaena | Masai Mara National Reserve, Kenya | 89.00 | Boydston et al., 2003 |
| Spotted hyaena | Etosha National Park, Namibia (dry season) | 160.00 | Trinkel et al., 2006 |

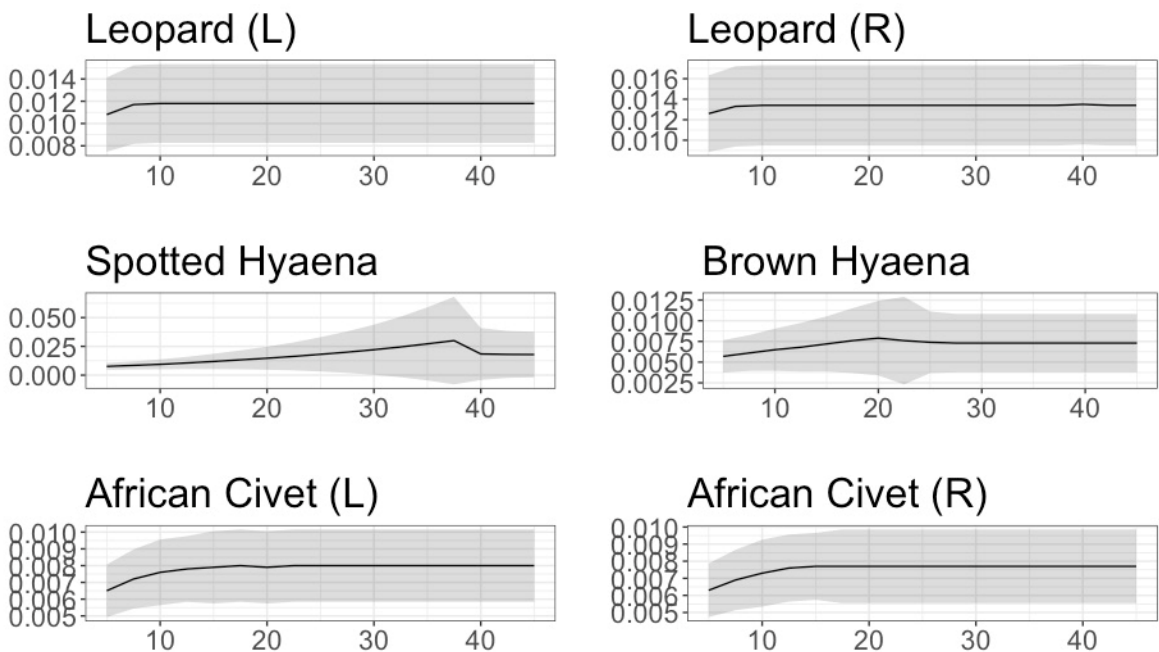
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|----------------|--|--------|-----------------------------|
| Spotted hyaena | Ongava Game Reserve, Namibia | 239.60 | Stratford & Stratford, 2011 |
| Spotted hyaena | Etosha National Park, Namibia (wet season) | 320.00 | Trinkel et al., 2006 |
| Spotted hyaena | Ongava Game Reserve, Namibia | 365.90 | Stratford & Stratford, 2011 |
| Spotted hyaena | Namib-Naukluft Park, Namibia | 383.00 | Tilson & Henschel, 1986 |
| Spotted hyaena | Namib-Naukluft Park, Namibia | 514.00 | Tilson & Henschel, 1986 |
| Spotted hyaena | Namib-Naukluft Park, Namibia | 570.00 | Tilson & Henschel, 1986 |
| <i>Mean</i> | | 145.91 | |
| Brown hyaena | Ben Alberts Nature Reserve, South Africa | 27.00 | Richmond-Coggan, 2014 |
| Brown hyaena | Pilanesberg National Park, South Africa | 28.00 | Richmond-Coggan, 2014 |
| Brown hyaena | Tweeldstrum Farm, South Africa | 38.00 | Richmond-Coggan, 2014 |
| Brown hyaena | Kwande Private Game Reserve, South Africa | 43.00 | Welch et al., 2016 |
| Brown hyaena | Bullsprit Farm, South Africa | 50.00 | Richmond-Coggan, 2014 |
| Brown hyaena | Kwande Private Game Reserve, South Africa | 72.00 | Welch et al., 2016 |
| Brown hyaena | Kwande Private Game Reserve, South Africa | 80.00 | Welch et al., 2016 |
| Brown hyaena | Pilansberg National Park, South Africa | 95.00 | Richmond-Coggan, 2014 |
| Brown hyaena | Western Soutpansberg, South Africa | 95.00 | Williams, 2017 |
| Brown hyaena | Pilansberg National Park, South Africa | 98.00 | Richmond-Coggan, 2014 |
| Brown hyaena | Madikwe Game, South Africa | 121.00 | Richmond-Coggan, 2014 |
| Brown hyaena | Makgadikgadi Pans, Botswana | 135.00 | Maude, 2005 |
| Brown hyaena | Western Soutpansberg, South Africa | 170.00 | Williams, 2017 |
| Brown hyaena | Mountain Zebra National Park, South Africa | 172.00 | Welch et al., 2016 |
| Brown hyaena | Makgadikgadi Pans, Botswana | 172.00 | Maude, 2005 |
| Brown hyaena | Makgadikgadi Pans, Botswana | 176.00 | Maude, 2005 |
| Brown hyaena | Madiwe Game, South Africa | 177.00 | Richmond-Coggan, 2014 |
| Brown hyaena | Mountain Zebra National Park, South Africa | 192.00 | Welch et al., 2016 |
| Brown hyaena | Makgadikgadi Pans, Botswana | 202.00 | Maude, 2005 |
| Brown hyaena | Makgadikgadi Pans, Botswana | 204.00 | Maude, 2005 |
| Brown hyaena | Mountain Zebra National Park, South Africa | 205.00 | Welch et al., 2016 |
| Brown hyaena | Makgadikgadi Pans, Botswana | 216.00 | Maude, 2005 |
| Brown hyaena | Makgadikgadi Pans, Botswana | 221.00 | Maude, 2005 |
| Brown hyaena | Makgadikgadi Pans, Botswana | 447.00 | Maude, 2005 |
| <i>Mean</i> | | 143.17 | |
| African civet | Wondo Genet, Ethiopia | 0.74 | Ayalew et al., 2013 |
| African civet | Wondo Genet, Ethiopia | 0.82 | Ayalew et al., 2013 |
| <i>Mean</i> | | 0.78 | |

SUPPLEMENTARY FIG. 1. Effect of varying buffer sizes on density and **related spatial** (a) density, (b) detection probability, and (c) spatial scale (σ) parameter estimates for leopard *Panthera pardus*, spotted hyaena *Crocuta crocuta*, brown hyaena *Parahyaena brunnea*, and African civet *Civettictis civetta* from Platjan, South Africa.

(a) Density

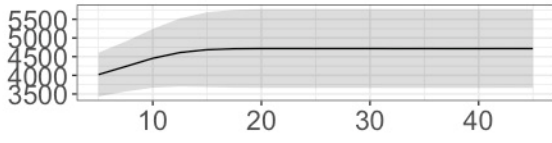


(b) Detection probability

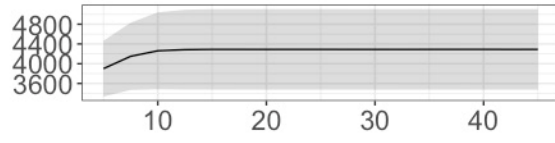


(c) **Spatial scale parameter**

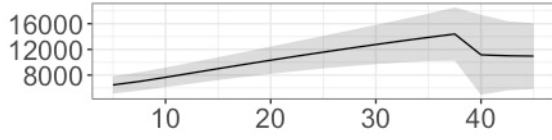
Leopard (L)



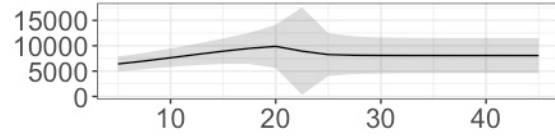
Leopard (R)



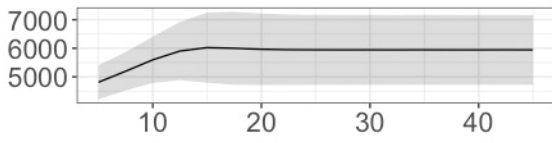
Spotted Hyaena



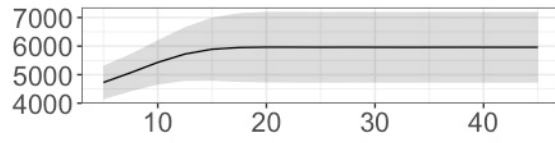
Brown Hyaena



African Civet (L)



African Civet (R)



SUPPLEMENTARY TABLE 2 Density estimates from camera trap studies in protected and non-protected areas from similar habitats in southern Africa. SCR = Spatial capture-recapture; Occ = Occupancy modelling; Tracks = Track counts; MR = Mark-recapture.

| Species | Location | Land Use | Method | D | Lower 95% | Upper 95% | Source |
|----------------|-------------------------------|--------------------|--------|-------|-----------|-----------|-------------------------|
| African civet | Platjan Agric. Area (2017) | Non-Protected Area | SCR | 3.60 | 2.34 | 5.57 | Results |
| African civet | Ngamiland District (2015) | Non-Protected Area | SCR | 10.70 | 8.46 | 13.58 | Rich et al., 2019 |
| African civet | Waterberg Agric. Area (2009) | Non-Protected Area | SCR | 4.88 | 2.82 | 6.94 | Isaacs et al., in press |
| African civet | Lapalala GR (2009) | Protected Area | SCR | 8.63 | 4.12 | 13.14 | Isaacs et al., in press |
| African civet | Mogalakwena (2014) | Protected Area | SCR | 13.30 | 11.26 | 15.34 | Amiard, 2014 |
| African civet | Moyo Reserve (2014) | Protected Area | SCR | 14.18 | 11.75 | 16.61 | Amiard, 2014 |
| African civet | Thaba Tholo (2014) | Protected Area | SCR | 12.52 | 12.15 | 12.89 | Amiard, 2014 |
| African civet | Welgevonden GR (2009) | Protected Area | SCR | 4.43 | 2.22 | 6.64 | Isaacs et al., in press |
| Brown hyaena | Platjan Agric. Area (2017) | Non-Protected Area | SCR | 0.74 | 0.30 | 1.88 | Results |
| Brown hyaena | Ghanzi Agric. Area 1 (2009) | Non-Protected Area | SCR | 2.81 | 0.71 | 5.36 | Kent & Hill, 2013 |
| Brown hyaena | Ghanzi Agric. Area 2 (2009) | Non-Protected Area | SCR | 1.80 | 0.18 | 3.38 | Kent & Hill, 2013 |
| Brown hyaena | Ghanzi Agric. Area 3 (2009) | Non-Protected Area | SCR | 2.28 | 0.26 | 4.30 | Kent & Hill, 2013 |
| Brown hyaena | North-West Province (2008) | Non-Protected Area | Occ | 0.75 | 0.00 | 0.90 | Thorn et al., 2011 |
| Brown hyaena | Central Kalahari GR (2015) | Protected Area | Tracks | 2.94 | 2.16 | 3.71 | Winterbach et al., 2017 |
| Brown hyaena | Kwandwe NR (2015) | Protected Area | SCR | 15.30 | NA | NA | Welch et al., 2016 |
| Brown hyaena | Okonjima NR (2018) | Protected Area | SCR | 24.01 | 18.12 | 31.81 | Edwards et al., 2019 |
| Brown hyaena | Pilanesberg NP (2007) | Protected Area | Occ | 2.80 | 2.60 | 5.20 | Thorn et al., 2009 |
| Spotted hyaena | Platjan Agric. Area (2017) | Non-Protected Area | SCR | 0.22 | 0.06 | 0.81 | Results |
| Spotted hyaena | Central Tuli (2019) | Non-Protected Area | SCR | 14.9 | 10.53 | 19.27 | Vissia et al., 2019 |
| Spotted hyaena | Ngamiland District (2015) | Non-Protected Area | SCR | 10.10 | 8.69 | 11.63 | Rich et al., 2019 |
| Spotted hyaena | Tsauchab River Valley (2015) | Non-Protected Area | SCR | 0.85 | 0.64 | 1.1 | Fouche et al., 2020 |
| Spotted hyaena | uMkhuze NR (2013) | Protected Area | SCR | 10.59 | 6.69 | 14.86 | De Blocq 2014 |
| Leopard | Platjan Agric. Area (2017) | Non-Protected Area | SCR | 2.20 | 1.32 | 3.68 | Results |
| Leopard | Maputoland Agric. Area (2005) | Non-Protected Area | MR | 2.49 | 0.78 | 4.20 | Balme et al., 2010 |
| Leopard | Namibian Agric. Area (2006) | Non-Protected Area | MR | 3.60 | 3.00 | 8.00 | Stein et al., 2011 |
| Leopard | Western Soutpansberg (2008) | Non-Protected Area | SCR | 10.73 | 4.68 | 17.33 | Chase Grey et al., 2013 |

| | | | | | | | |
|---------|-----------------------------|--------------------|-----|-------|-------|-------|-----------------------|
| Leopard | Western Soutpansberg (2012) | Non-Protected Area | SCR | 6.80 | 3.57 | 10.18 | Williams et al., 2017 |
| Leopard | Western Soutpansberg (2013) | Non-Protected Area | SCR | 4.96 | 2.47 | 7.70 | Williams et al., 2017 |
| Leopard | Western Soutpansberg (2014) | Non-Protected Area | SCR | 4.47 | 2.10 | 6.90 | Williams et al., 2017 |
| Leopard | Western Soutpansberg (2015) | Non-Protected Area | SCR | 4.18 | 1.97 | 6.08 | Williams et al., 2017 |
| Leopard | Lapalala GR (2016) | Protected Area | SCR | 4.33 | 2.17 | 6.49 | Rogan et al., 2019 |
| Leopard | Lapalala GR (2017) | Protected Area | SCR | 5.60 | 3.29 | 7.91 | Rogan et al., 2019 |
| Leopard | Lapalala GR (2018) | Protected Area | SCR | 4.88 | 2.63 | 7.13 | Rogan et al., 2019 |
| Leopard | Madikwe NR (2017) | Protected Area | SCR | 2.74 | 0.78 | 4.70 | Rogan et al., 2019 |
| Leopard | Madikwe NR (2018) | Protected Area | SCR | 6.55 | 0.00 | 15.74 | Rogan et al., 2019 |
| Leopard | Mapesu GR (2018) | Protected Area | SCR | 3.66 | 1.54 | 5.78 | Rogan et al., 2019 |
| Leopard | N'wanetsi Concession (2008) | Protected Area | MR | 12.70 | 12.70 | 12.70 | Maputla et al., 2013 |
| Leopard | Venetia-Limpopo GR (2014) | Protected Area | SCR | 6.52 | 3.21 | 9.83 | Rogan et al., 2019 |
| Leopard | Venetia-Limpopo GR (2015) | Protected Area | SCR | 4.86 | 2.21 | 7.51 | Rogan et al., 2019 |
| Leopard | Venetia-Limpopo GR (2016) | Protected Area | SCR | 6.23 | 3.39 | 9.07 | Rogan et al., 2019 |
| Leopard | Venetia-Limpopo GR (2017) | Protected Area | SCR | 5.06 | 2.83 | 7.29 | Rogan et al., 2019 |
| Leopard | Waterberg Plateau NP (2006) | Protected Area | MR | 1.00 | 0.80 | 1.50 | Stein et al., 2011 |
| Leopard | Welgevonden GR (2013) | Protected Area | SCR | 3.40 | 1.73 | 5.07 | Rogan et al., 2019 |
| Leopard | Welgevonden GR (2014) | Protected Area | SCR | 3.76 | 2.07 | 5.45 | Rogan et al., 2019 |
| Leopard | Welgevonden GR (2015) | Protected Area | SCR | 2.24 | 1.12 | 3.36 | Rogan et al., 2019 |
| Leopard | Welgevonden GR (2016) | Protected Area | SCR | 3.10 | 1.04 | 5.16 | Rogan et al., 2019 |
| Leopard | Welgevonden GR (2017) | Protected Area | SCR | 4.35 | 1.90 | 6.80 | Rogan et al., 2019 |
| Leopard | Welgevonden GR (2018) | Protected Area | SCR | 6.07 | 3.15 | 8.99 | Rogan et al., 2019 |
| Leopard | Wonderkop NR (2013) | Protected Area | SCR | 2.13 | 0.76 | 3.50 | Rogan et al., 2019 |
| Leopard | Wonderkop NR (2014) | Protected Area | SCR | 0.87 | 0.38 | 1.36 | Rogan et al., 2019 |
| Leopard | Wonderkop NR (2015) | Protected Area | SCR | 2.97 | 0.70 | 5.24 | Rogan et al., 2019 |
| Leopard | Zingela NR (2016) | Protected Area | SCR | 3.65 | 1.49 | 5.81 | Rogan et al., 2019 |
| Leopard | Zingela NR (2018) | Protected Area | SCR | 5.08 | 2.28 | 7.88 | Rogan et al., 2019 |

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