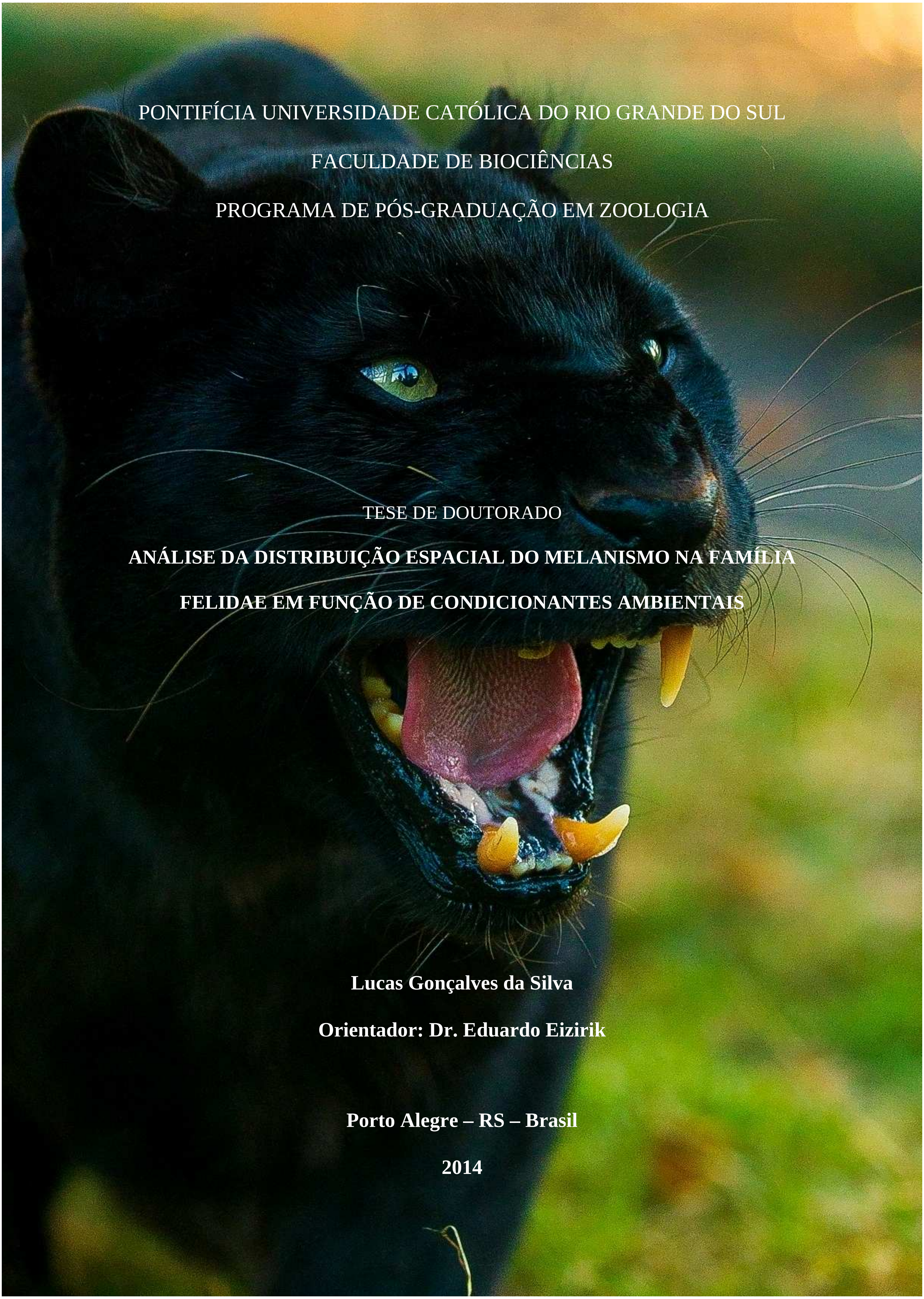

PONTIFÍCIA UNIVERSIDADE CATÓLICA DO RIO GRANDE DO SUL

FACULDADE DE BIOCIÊNCIAS

PROGRAMA DE PÓS-GRADUAÇÃO EM ZOOLOGIA

TESE DE DOUTORADO

ANÁLISE DA DISTRIBUIÇÃO ESPACIAL DO MELANISMO NA FAMÍLIA FELIDAE EM FUNÇÃO DE CONDICIONANTES AMBIENTAIS

Lucas Gonçalves da Silva

Orientador: Dr. Eduardo Eizirik

Porto Alegre – RS – Brasil

2014

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Tese apresentada como requisito para obtenção do grau de Doutor pelo Programa de Pós-Graduação em Zoologia da Faculdade de Biociências da Pontifícia Universidade Católica do Rio Grande do Sul.

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Aprovada em: _____ de ____________________ de ______.

BANCA EXAMINADORA:

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Prof. Dr.

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Prof. Dr.

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Prof. Dr.

Porto Alegre – RS – Brasil

2014

Aos que acreditaram, incentivaram e colaboraram com esse projeto.

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"Earth and sky, woods and fields, lakes and rivers, the mountain and the sea, are excellent schoolmasters, and teach some of us more than we can ever learn from books."

- John Lubbock (The Use of Life, 1894) -

SUMÁRIO

RESUMO

A variação na coloração animal é um tema que intriga pesquisadores da área de biologia evolutiva há bastante tempo. Dentre as variações observadas, o melanismo é um polimorfismo de coloração comum em diversos grupos de organismos, definido pela predominância de uma cor escura na superfície do corpo. Diversos fatores biológicos, como termorregulação, suscetibilidade ou resposta a doenças, camuflagem, aposematismo, seleção sexual e sucesso reprodutivo podem ser influenciados pelo melanismo, o que torna o seu estudo bastante relevante, inclusive como um sistema modelo para investigações evolutivas de polimorfismos fenotípicos em geral. Sua ocorrência é comum na família Felidae, tendo sido documentada em 13 das 38 espécies do grupo e, em alguns casos, podendo atingir altas frequências em certas populações. Hipóteses clássicas sugerem que essas variantes de pelagem podem apresentar vantagens adaptativas em certas circunstâncias ecológicas, o que até o momento não foi testado de forma rigorosa para qualquer das espécies do grupo. O presente estudo teve como foco o melanismo em três espécies de felídeos: onças-pintadas (*Panthera onca*), jaguarundis (*Puma yagouaroundi*) e leopardos (*Panthera pardus*), nas quais esta variante é causada por diferentes mutações nos genes *MC1R* e *ASIP*, de herança dominante, semi-dominante e recessiva, respectivamente. No presente estudo, para cada uma destas espécies, foram consideradas duas hipóteses concorrentes: (I) o melanismo constitui um polimorfismo neutro, presente em toda a área de distribuição e de forma aleatória entre ambientes distintos, com ausência de associação com variáveis ambientais; e (II) o melanismo está distribuído espacialmente de forma estruturada e não-randômica, e associada a parâmetros ambientais e condicionantes biogeográficos específicos. A partir de registros provenientes de coleções científicas, armadilhas fotográficas, capturas e DNA fecal cobrindo a maior parte da distribuição geográfica das espécies focais, foram obtidas 794 amostras de onças-pintadas, 463 de jaguarundis e 623 de leopardos, com aferição da coloração em nível individual. As modelagens e análises estatísticas foram realizadas com os programas Maxent (algoritmo de máxima entropia), ArcGis 9.3 e SPSS 17, utilizando variáveis ambientais obtidas a partir das bases de dados WorldClim, Climond, SRTM e GlobCover. Os resultados apresentam pela primeira vez um mapa de distribuição geográfica do melanismo em felinos, bem como estimativas da frequência dessa característica nestas três espécies. A frequência observada de melanismo foi de 9% em onças-pintadas, 80% em jaguarundis e 10% em leopardos, sendo que em todas as espécies o padrão de distribuição geográfica foi significativamente não-aleatório. Nas onças-pintadas, em ecoregiões de paisagens abertas periodicamente inundadas como o Pantanal (Brasil) e os Llanos (Colômbia/Venezuela), o melanismo foi totalmente ausente, apesar do grande número de amostras provenientes destas regiões, ao contrário de áreas florestais, onde a frequência do melanismo se manteve semelhante ao esperado para a espécie como um todo. Em jaguarundis, o padrão fenotípico escuro (que é evolutivamente derivado) mostrou-se muito mais comum na natureza do que a coloração ancestral (avermelhada), estando o primeiro distribuído em todas as áreas de ocorrência da espécie, e a segunda associada fortemente a paisagens mais secas e abertas. Em leopardos, o melanismo está presente em cinco das nove subespécies atualmente reconhecidas, e fortemente associado a florestas tropicais e subtropicais úmidas, especialmente na região do sudeste asiático. Análises dos parâmetros ambientais que parecem influenciar de forma mais relevante a ocorrência do melanismo nestas três espécies sugerem um papel importante de fatores como altitude, temperatura, radiação solar e umidade em diferentes conformações de paisagem. Essas observações apoiam a hipótese de que o melanismo em felinos não constitui um polimorfismo neutro, sofrendo a ação de seleção natural relacionada a variáveis ambientais e conformações de paisagem, o que induz uma distribuição geográfica não-aleatória deste fenótipo de coloração.

Palavras-chave: fenótipo, melanismo, polimorfismo, biomas, felinos, seleção natural.

ABSTRACT

Variation in animal coloration is a theme that has intrigued evolutionary biologists for a long time. Among the commonly observed pigmentation polymorphisms, melanism (darkening of the surface coloration) has been reported quite frequently in multiple groups of organisms. Several biological factors may be influenced by melanism, including thermoregulation, susceptibility or response to disease, camouflage, aposematism, sexual selection and reproductive success. Melanism is common in the Felidae, having been documented in 13 of its 38 species, in some cases reaching high frequencies in natural populations. Classical hypothesis have suggested that such coat color variants can present adaptive advantages under certain ecological conditions, but these ideas have never been rigorously tested for any wild cat species. In jaguars (*Panthera onca*), jaguarundis (*Puma yagouaroundi*) and leopards (*Panthera pardus*) melanism is caused by different mutations in the *MC1R* and *ASIP* genes, which present dominant, semi-dominant and recessive inheritance patterns, respectively. In this study we have focused on melanism in these three cat species, and considered two competing hypotheses: (I) melanism is a neutral polymorphism that is randomly distributed throughout the range of each of these species, bearing no association with particular habitats or environmental variables; and (II) melanism has a non-random distribution, and presents significantly different frequencies among distinct landscape conformations. We constructed databases of records obtained from scientific collections, camera trap studies, individual captures and fecal DNA samples that collectively covered most of the ranges of the focal species. We obtained 794 records of jaguars, 463 jaguarundis and 623 leopards, including individually ascertained information on coat color. We performed modeling and statistical analyses using the software packages Maxent (maximum entropy algorithm), ArcGis 9.3 and SPSS 17, based on environmental variables obtained from the Worldclim, Climond, SRTM and GlobCover databases. The results allowed for the first time the construction of maps depicting the geographic distribution of melanism in wild cat species, as well as estimates of its frequency in the three target species. The frequency of melanism was *ca.* 9% in jaguars, 80% in jaguarundis, and 10% in leopards, and all three species showed a non-random distribution pattern of this coloration variant. In jaguars, melanism was totally absent from ecoregions containing open and periodically flooded landscapes, such as the Pantanal (Brazil) and Llanos (Colombia/Venezuela), which was striking given the large number of samples surveyed in these regions; in contrast, forested areas displayed a melanism frequency that was similar to that expectation based on the species as a whole. In jaguarundis, the dark phenotype (which is evolutionarily derived) proved to be much more common in nature than the ancestral reddish form, with the former being distributed across all areas in which the species occurs, and the latter being highly associated with open and dry landscapes. In leopards, melanism was present in five of the nine currently recognized subspecies, and was strongly associated with tropical and subtropical moist forests, especially in Southeast Asia. Analyses of environmental parameters that seem to be most influential on the melanism occurrence in these three species suggest a relevant role for factors such as altitude, temperature, solar radiation and moisture in different landscape conformations. These observations support the hypothesis that melanism in felids is not a neutral polymorphism, and undergoes the influence of natural selection related to environmental variables and landscape conformations, leading to a non-random geographic distribution of this coloration phenotype.

Keywords: phenotype, melanism, polymorphism, biomes, felids, natural selection.

CAPÍTULO 1:

INTRODUÇÃO GERAL

1. Diversidade de coloração e o melanismo em populações naturais

A grande variedade de padrões de coloração observada no reino animal é um tema de especial interesse no que tange à compreensão dos mecanismos que geram e mantêm essa variação. A base molecular, o significado adaptativo e a influência de processos evolutivos sobre características fenotípicas ainda são lacunas do conhecimento e há bastante tempo intrigam pesquisadores na área da biologia evolutiva. A variação fenotípica é diretamente influenciada pela evolução, portanto, é importante conhecer quantos e quais genes estão associados a variantes de coloração, identificar a existência de fenótipos convergentes e mensurar como a atuação da seleção natural e processos demográficos afetam essa diversidade.

A relevância comportamental e ecológica da coloração animal pode ser fruto de papel adaptativo em alguns contextos. Características funcionais das espécies podem ser afetadas diretamente pela variação de coloração: (I) camuflagem (efeito de confusão entre a coloração do ambiente e do animal afetando sua detecção visual) ou coloração disruptiva (padrões de coloração que confundem os contornos do animal); (II) comunicação intraespecífica (interação de indivíduos da mesma espécie) ou interespecífica (comunicação entre espécies distintas, aposematismo) e; (III) processos fisiológicos como termorregulação ou suscetibilidade a doenças e patógenos (Cott, 1940; Majerus, 1998; Caro, 2005). Apesar desses conceitos serem recentes dentro da Ecologia, uma antiga regra zoológica proposta por Gloger (1833) cita a associação de animais endotérmicos de coloração mais pigmentada com ambientes mais úmidos, baseada em um estudo de plumagem em aves. Entretanto, a 'regra de Gloger' como é conhecida fundamenta-se em observações, proposições anedóticas e especulações sobre a seleção Darwiniana atuando na coloração animal, porém sem ter sofrido até o momento algum rigoroso teste da hipótese. O tema veio a ser novamente estudado por Poulton (1890) com foco em lepidópteros, posteriormente por Beddard (1895) e mais recentemente por Burtt & Ichida (2004).

Existem três diferentes possibilidades evolutivas para a ocorrência de fenótipos semelhantes em espécies distintas. No primeiro caso, uma mesma mutação em um determinado gene pode causar convergência adaptativa (Ling *et al*., 2003; Rompler *et al*., 2006). Em um segundo caso, diferentes mutações no mesmo gene podem produzir um fenótipo semelhante (Rosenblum, 2006) ou, em um terceiro caso, mutações em diferentes genes estão associadas ao mesmo fenótipo (Hoekstra, 2006). Além disto, há a possibilidade de uma determinada mutação envolvida com padrões fenotípicos ter ocorrido uma vez no passado e ser mantida por meio de processos de especiação subsequentes, que deram origem aos táxons atuais (Colosimo *et al.*, 2005). Ou ainda o surgimento da mutação em uma determinada linhagem e sua transferência a outras através de processos de hibridação ou introgressão (Anderson *et al.*, 2009). Essas possibilidades até o momento foram pouco exploradas em sistemas naturais e carecem de novas investigações.

O melanismo é um polimorfismo de coloração bastante comum em diversos grupos de organismos, em que se observa um escurecimento geral do tegumento (pigmentação superficial) em relação ao que seria considerado o padrão fenotípico normal ou selvagem, devido à alta produção de melanina (Majerus, 1998). É uma característica que evoluiu em uma ampla variedade de formas de vida, documentada tanto em laboratório (Silvers, 1979; Barsh, 1995) quanto em populações naturais (Searle, 1968). Existem hipóteses clássicas que postulam um potencial papel adaptativo do melanismo em diferentes espécies, envolvendo diversos possíveis impactos na sobrevivência ou reprodução dos indivíduos (por exemplo: Cott, 1940; Ortolani & Caro, 1996; Majerus, 1998; Caro, 2005). Diversos fatores biológicos como termorregulação, suscetibilidade ou resposta a doenças, camuflagem, aposematismo, seleção sexual e sucesso reprodutivo podem ser diretamente influenciados pelo melanismo, sendo que na maior parte dos casos tais possibilidades ainda não foram testadas de forma completa e rigorosa (Majerus, 1998).

Os mamíferos são um grupo de evidentes e variadas características fenotípicas, tanto entre espécies quanto em nível intraespecífico, tornando-se um promissor modelo de estudo sobre polimorfismos (Hubbard *et al.*, 2010), incluindo o melanismo. O foco deve ser na descoberta de quais são os genes envolvidos, as exatas mutações que implicam em características fenotípicas e seus efeitos em funções proteicas regulatórias (Barsh, 1996; Hubbard *et al.*, 2010). Entretanto, existem poucos estudos acerca da associação fenótipo/genótipo em populações naturais visando elucidar o significado adaptativo desta variante de pigmentação (Vage *et al.*, 1997; Rieder *et al.*, 2001; Hoekstra, 2006; Ishida *et al.*, 2006; Candille *et al.*, 2007). Existem dois principais locos gênicos responsáveis pela ocorrência do melanismo em mamíferos: *MC1R* (*Receptor de Melanocortina-1*) e *ASIP* (*Proteína Sinalizadora de Agouti*) (Robbins *et al.*, 1993; Perry *et al.*, 1996). A interação dos produtos regulados pelos genes *MC1R* e *ASIP* influencia diretamente a produção de melanina. Fenótipos melânicos são associados com mutações de herança dominante no gene *MC1R* (Jackson, 1994) ou mutações de herança recessiva no gene *ASIP* (Robbins *et al*., 1993). De forma sucinta, o ganho-de-função da proteína *MC1R* ou a perda-de-função da *ASIP* induzem o melanismo em mamíferos. A identificação desses genes como candidatos a responsáveis pela variação de coloração de vertebrados é descrita em vários trabalhos. Polimorfismos no *MC1R* estão associados ao melanismo em raposas (Vage *et al*., 1997), porcos (Kijas *et al*., 1998), ovelhas (Vage *et al*., 1999), vacas (Klungland *et al*., 1995), onças-pintadas/jaguarundis (Eizirik *et al*., 2003), aves (Takeuchi *et al*., 1996; Theron *et al*., 2001), roedores (Nachman *et al*., 2003), primatas (Mundy & Kelly, 2003) e esquilos (McRobie *et al*., 2009). Já polimorfismos no gene *ASIP* estão associados ao melanismo em ratos (Kuramoto *et al*., 2001; Kingsley *et al*., 2009), cavalos (Rieder *et al*., 2001), gatos domésticos (Eizirik *et al*., 2003) e leopardos (Schneider *et al*., 2012).

2. Ocorrência do melanismo em felinos

A família Felidae é um grupo potencialmente excelente como modelo investigativo de complexos processos evolutivos relacionados com a pigmentação da pelagem em populações naturais. A ocorrência de pigmentação polimórfica é comum em felinos domésticos e selvagens, apresentando variação na pigmentação de fundo e na presença, forma, coloração e distribuição de pintas e manchas. Esses distintos padrões sempre serviram de base para clássicas hipóteses de associações ecológicas em ambientes distintos e, dentre as variações na coloração da pelagem, uma das mais comuns na família Felidae é o melanismo. Essa característica variação fenotípica está presente em 13 das atuais 38 espécies do grupo (Eizirik *et al*., 2003; Schneider *et al*., 2012) (Figura 1).

Alguns destes casos são muito conhecidos. Onças-pintadas (*Panthera onca*) e leopardos (*Panthera pardus*) melânicos possuem pelagem totalmente diferente do padrão usual ("selvagem") pintado da espécie (fundo claro com rosetas) (Wallace, 1877; Pocock, 1929; Pocock, 1930; Nelson & Goldman, 1933; Searle, 1968; Robinson, 1970, Allen *et al*., 2010). Esses animais apresentam escurecimento da coloração de fundo, tornando-a quase que completamente preta (Ulmer, 1941; Robinson, 1976; Sunquist & Sunquist, 2002; Wilson & Mittermeier, 2009; Schneider *et al*., 2012) e são conhecidos popularmente como panteras negras. Ao contrário, a coloração melânica do jaguarundi (*Puma yagouaroundi*) tem uma variação entre o acinzentado e o cinza-chumbo e difere completamente da pelagem avermelhada (Searle, 1968; Robinson, 1976; Wilson & Mittermeier, 2009), a qual representa o estado ancestral nesta espécie (Eizirik *et al.*, 2003).

Linhagem	Foto	Espécie	Melanismo
Linhagem do gato-doméstico		*Felis catus*	Presente / Mutação conhecida*
		Felis silvestris	------
		Felis libyca	------
		Felis bieti	------
		Felis margarita	------
		Felis nigripes	------
		Felis chaus	Presente / Mutação desconhecida
Linhagem do leopard cat		*Otocolobus manul*	------
		Prionailurus rubiginosus	------
		Prionailurus bengalensis	------
		Prionailurus viverrinus	------
		Prionailurus planiceps	------
Linhagem do puma		*Puma concolor*	------
		Puma yagouaroundi	Presente / Mutação conhecida*
		Acinonyx jubatus	------
Linhagem do lynx		*Lynx pardinus*	------
		Lynx lynx	------
		Lynx canadensis	------
		Lynx rufus	Presente / Mutação desconhecida
Linhagem da jaguatirica		*Leopardus pardalis*	------
		Leopardus wiedii	------
		Leopardus jacobita	------
		Leopardus colocolo	Presente / Mutação conhecida***
		Leopardus geoffroyi	Presente / Mutação conhecida***
		Leopardus guigna	Presente / Mutação conhecida***
		Leopardus tigrinus	------
		Leopardus guttulus	Presente / Mutação desconhecida
Linhagem do caracal		*Caracal caracal*	------
		Caracal aurata	------
		Caracal serval	Presente / Mutação desconhecida
Linhagem do bay cat		*Pardofelis badia*	------
		Pardofelis temminckii	Presente / Mutação conhecida**
		Pardofelis marmorata	Presente / Mutação desconhecida
Linhagem das panteras		*Panthera leo*	------
		Panthera onca	Presente / Mutação conhecida*
		Panthera pardus	Presente / Mutação conhecida**
		Panthera tigris	------
		Panthera uncia	------
		Neofelis nebulosa	------

* Eizirik *et al*. (2003)   ** Schneider *et al*. (2012)   *** Schneider (2013)

Figura 1 - Ocorrências do melanismo na família Felidae.

O gene *MC1R* em felinos consiste em um éxon de 951 pb (317 códons) com estrutura similar à de outros mamíferos (Mountjoy *et al*., 1992; Robbins *et al*., 1993; Vage *et al*., 1999). A ocorrência de melanismo em onças-pintadas e jaguarundis é provocada por duas diferentes deleções no gene *MC1R*. Onças melânicas possuem uma sequência alélica mutante com ausência de 15 pb (5 códons), como resultado de uma deleção nas posições 301-315. Os jaguarundis melânicos possuem uma segunda deleção no gene *MC1R*, na qual são removidos 24 pb (8 códons) em uma posição adjacente, distinta da encontrada nas onças-pintadas. Essas deleções derivam de eventos de mutação independentes e refletem heranças de efeito dominante e semidominante, respectivamente (Eizirik *et al*., 2003). No caso das onças-pintadas, foi encontrada concordância de 100% com um padrão dominante de herança do melanismo a partir da análise de indivíduos amostrados ao longo da distribuição geográfica da espécie (Eizirik *et al.* 2003; Haag *et al*., 2010I) e, no jaguarundi, a semidominância desta variante de pelagem foi inferida através de uma abordagem semelhante (Eizirik *et al.* 2003). Já nos leopardos a ocorrência do melanismo é provocada por uma mutação localizada no exon 4 do gene *ASIP*, inserindo um códon de parada na posição 111, o que provavelmente elimina por completo a função da proteína codificada (Schneider *et al*., 2012). A descoberta da mutação causadora do melanismo em leopardos corroborou a anteriormente conhecida herança recessiva proposta por Robinson (1969) e foi inferida a partir de amostras do sudeste da Ásia (Schneider *et al*., 2012), área conhecida pela alta frequência de indivíduos melânicos (Kawanishi *et al*., 2010).

Análises recentes indicam que o melanismo surgiu independentemente pelo menos oito vezes dentro da família Felidae (Schneider *et al*., 2012), representando sete das oito linhagens evolutivas do grupo (Johnson *et al*., 2006), em alguns casos atingindo frequências populacionais bastante altas (por exemplo, Dittrich, 1979; Kawanishi *et al.*, 2010). Tais observações apoiam a hipótese de que o melanismo pode trazer uma vantagem adaptativa em certas circunstâncias ecológicas (Ulmer, 1941; Eizirik & O'Brien, 2003; Caro, 2005; Allen *et al*., 2010). Referências que remetem ao século 19 e à primeira metade do século 20 citam a hipótese de associação de indivíduos escuros com áreas mais úmidas e de formações vegetais densas (por exemplo, florestas tropicais) (Gloger, 1833; Poulton, 1890; Cott, 1940; Ulmer, 1941). Além disso, também está citada na bibliografia uma possível seleção negativa em relação aos indivíduos de pelagem escura em áreas abertas onde a incidência solar e as temperaturas médias são altas (Ortolani & Caro, 1996; Majerus, 1998). Apesar de estas hipóteses circularem na cultura popular há bastante tempo, e serem mencionadas periodicamente na literatura técnica como postulados anedóticos, elas nunca foram abordadas rigorosamente do ponto de vista científico e testadas de forma sistemática. A história evolutiva, os efeitos biológicos e mesmo a distribuição geográfica dessas variantes de coloração não são claramente conhecidos até o momento, de forma que o presente estudo se propõe a investigar estes tópicos pela primeira vez de maneira aprofundada.

3. Aspectos biológicos das espécies foco

Dentre as 13 espécies de felídeos em que existe a ocorrência confirmada do melanismo, três foram selecionadas para o presente estudo. Uma síntese dos principais aspectos biológicos das espécies-foco encontra-se a seguir:

3.1. A onça-pintada (*Panthera onca*) (Linneaus, 1758)

A onça-pintada é o maior felino das Américas, o terceiro maior do mundo e a única espécie representante do gênero *Panthera* no continente (Sunquist & Sunquist, 2002). É uma espécie de predadora de topo de cadeia (Maffei *et al*., 2004) de grande porte e vigor físico (Sunquist & Sunquist, 2002), carnívora, oportunista, de atividade preferencialmente noturna e possui uma dieta que inclui mais de 85 espécies de mamíferos, répteis e aves (Seymour, 1989).

A distribuição atual das onças-pintadas se estende por 18 nações (Figura 2). A porção sul dos Estados Unidos é o limite norte da distribuição da espécie e a Argentina é o seu limite sul (Sanderson *et al*., 2002; Sunquist & Sunquist, 2002; Caso *et al*., 2014). Indivíduos da espécie foram documentados nos últimos anos nos Estados Unidos (Brown & Gonzalez, 2000, Hatten *et al*., 2005; McCain & Childs, 2008), México (Ortega & Medley, 1999; Chavez & Ceballos, 2006; Dinets & Polechla, 2007; Vilchis *et al*., 2008; Perez, 2011), America Central (Silver *et al*., 2004; Perez *et al.*, 2007; Carillo *et al*., 2009; Zeller *et al*., 2011; Shoender & Main, 2013), Colômbia e Venezuela (Ruiz-Garcia *et al*., 2006; Jedrzejewski *et al*., 2011), Chaco Boliviano (Maffei *et al*., 2004; Silver *et al*., 2004), Amazônia Central (Wallace *et al*., 2003; Silver *et al*., 2004; Morato *et al*., 2013; Tobler *et al*., 2013), Pantanal (Soisalo & Cavalcanti, 2006; Cavalcanti & Gese, 2009; Morato *et al*., 2013), Mata Atlântica (Conforti & Azevedo 2003; Cullen Jr.

et al., 2005; Paviolo *et al*., 2006; Paviolo *et al*., 2008; Haag *et al*., 2010II; Jorge *et al*., 2013; Morato *et al*., 2013), Cerrado (Lima *et al*., 2013; Morato *et al*., 2013) e Caatinga (Silveira *et al*., 2009; Morato *et al*., 2013). Pode ser encontrada desde o nível do mar até 3.800m de altitude (Perry, 1970; Tewes & Schmidly, 1987), mas raramente ultrapassa os 1.200m (Seymour, 1989; Sunquist & Sunquist, 2002).

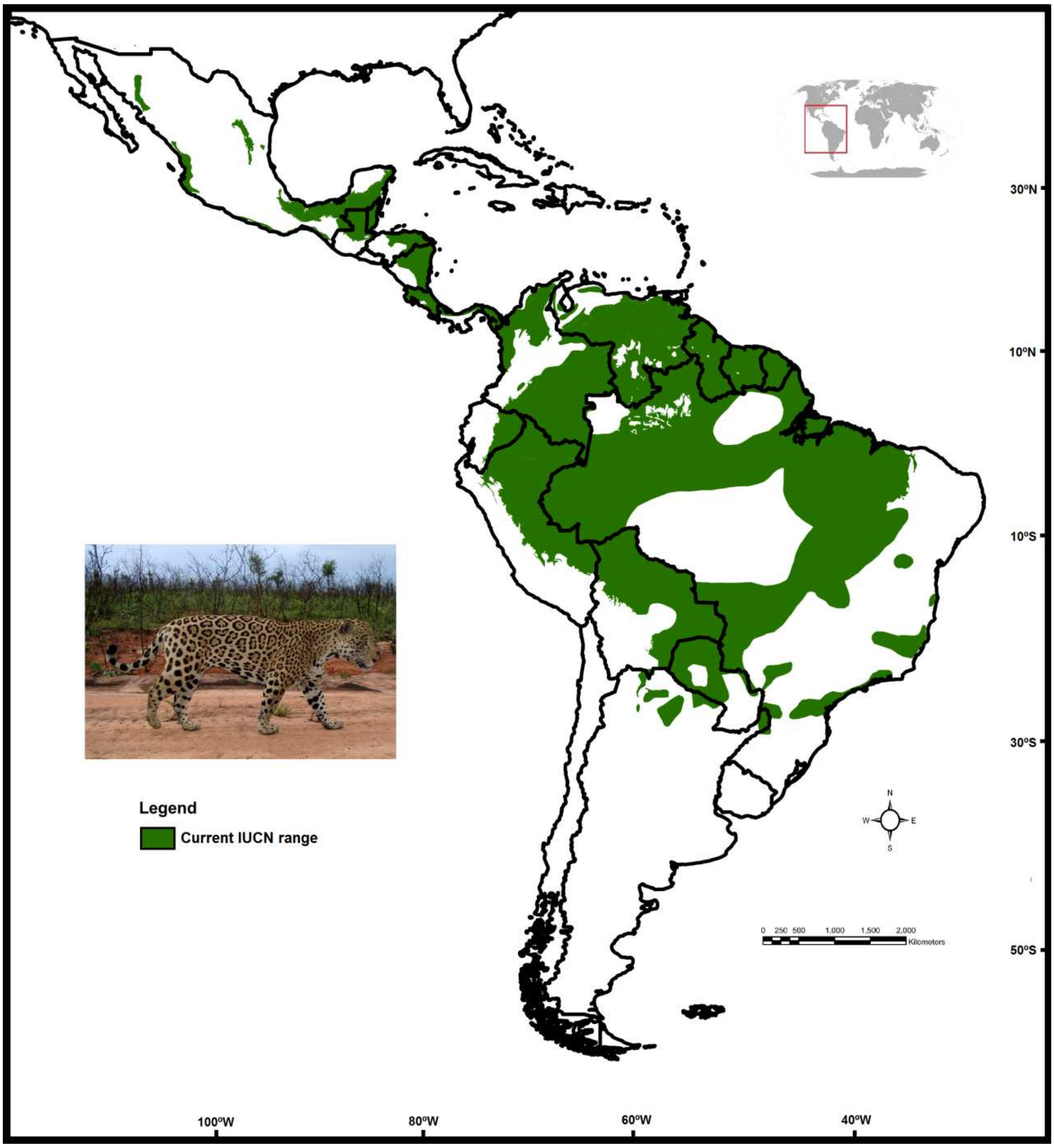


Figura 2 - Distribuição conhecida da onça-pintada (Fonte: IUCN).

As onças-pintadas estão presentes em uma grande diversidade de ambientes, desde florestas tropicais até áreas semi-áridas (Sunquist & Sunquist, 2002; Caso *et al*., 2013). Estudos de hábitats preferenciais indicam uma estreita relação da sobrevivência da espécie com corpos d’água e matas (Schaller & Crawshaw, 1980; Quigley & Crawshaw, 1992), quantidade suficiente de presas (Seymour, 1989; Swank & Teer, 1989; Paviolo *et al*., 2009) e escape de áreas fortemente antropizadas (Quigley & Crawshaw, 1992). Adicionalmente, a espécie apresenta baixa estruturação populacional ao longo de sua distribuição, não sendo identificadas significativas diferenciações genéticas em escalas continental ou regionais. Apenas o rio Amazonas (Amazônia Central) e o Estreito de Dárien (Panamá) foram identificados como possíveis barreiras históricas ao fluxo gênico, e ainda assim parecem não ter isolado completamente as populações do seu entorno (Eizirik *et al*., 2001).

A espécie é listada no apêndice 1 da CITES (*Convention on International Trade in Endangered Species of Wild Fauna and Flora*) (Hatten *et al*., 2005) e é considerada 'quase ameaçada' pela IUCN (*International Union for Conservation of Nature*) (Wozencraft, 1993; Caso *et al*., 2013) por conta da perda e fragmentação dos seus hábitats, além de conflitos diretos com atividades humanas (Eizirik *et al*., 2001; Campos *et al*., 2011; Carvalho & Morato, 2013). Além disso, algumas populações remanescentes podem constar como em situação crítica por estarem isoladas e possuírem poucos indivíduos (Eizirik *et al*., 2001; Haag *et al*. 2010; Galetti *et al*., 2013; Zeilhofer *et al*., 2014). Pelo fato de indivíduos da espécie ocuparem grandes extensões territoriais como suas áreas de vida (Cullen *et al*., 2005), as populações remanescentes distribuem-se em terras que vão além das fronteiras de áreas protegidas aumentando a probabilidade de extinção, principalmente por conta da caça e retaliação por parte de fazendeiros em função da predação de animais domésticos (Sanderson *et al*., 2002; Carvalho & Morato, 2013). Seu pico de declínio populacional ocorreu nos anos 1960 (Weber & Rabinowitz, 1996), exacerbando a redução de sua distribuição histórica, que hoje é 50% menor do que em 1900 (Sanderson *et al*., 2002) devido à sua extinção local em diversas áreas (Sunquist & Sunquist, 2002; Mazzoli, 2008). Neste contexto, planos de ação e listas locais (por exemplo: *Indrusiak & Eizirik, 2003;* Morato *et al*., 2013), além de modelos geográficos (Sanderson *et al*., 2002; Rabinowitz & Zeller, 2010), atualmente são as principais ferramentas para planejar e articular a conservação da espécie.

3.2. O jaguarundi (*Puma yagouaroundi*) (Geoffroy, 1803)

O jaguarundi é um felídeo Neotropical de pequeno porte e que possui dados deficientes sobre sua biologia, padrão de distribuição geográfica atual e sua situação populacional (Sunquist & Sunquist, 2002; Grassman & Tewes 2004; Maffei *et al*., 2007). A espécie apresenta comportamento mais ativo no período diurno (Oliveira, 1998; Maffei *et al*., 2007) e possui dieta generalista, alimentando-se preferencialmente de aves, répteis e pequenos mamíferos (Tófoli *et al*., 2009).

Sua distribuição geográfica é bastante semelhante à das onças-pintadas, ocorrendo desde o Texas (sul dos Estados Unidos) até o sul da América do Sul (Sunquist & Sunquist 2003; Almeida *et al*., 2013; Caso *et al*., 2013) (Figura 3). Registros dos últimos anos apontam a presença do jaguarundi na Mata Atlântica (Michalski *et al*., 2006; Tófoli *et al*., 2009; Bianchi *et al*., 2011), Cerrado (Trovati *et al*., 2008; Almeida *et al*., 2013), Caatinga (Feijó & Langguth, 2013), sul do Brasil (Indrusiak & Eizirik, 2003; Santos *et al*., 2004; Kasper *et al*., 2007), Chaco Boliviano (Maffei *et al*., 2007) e sul dos Estados Unidos (Grassman & Tewes, 2004; Grigione *et al*., 2007), ocorrendo com mais freqüência em baixas altitudes, mas podendo ser encontrado até 3.200m acima do nível do mar (Cuervo *et al*., 1986). Em outras áreas de sua distribuição histórica como Amazônia, Pantanal, Patagônia e América Central, a atual situação de ocorrência da espécie ainda é duvidosa.

A espécie é encontrada em diversas conformações de hábitats, podendo ocorrer desde áreas semiáridas e savanas até densas florestas secas e úmidas (Oliveira, 1998; Sunquist & Sunquist 2003) e aparenta não ter forte estruturação geográfica ao longo de sua distribuição (Pires, 2012). Está atualmente listada em várias listas regionais de espécies ameaçadas, constando como 'pouco preocupante' na lista da IUCN e citada pelos apêndices I e II da CITES (Caso *et al*., 2013). Sofre ameaça por conta da perda e fragmentação de hábitat e perseguição humana (Almeida *et al*., 2013; Caso *et al*., 2013), apesar de sua caça ser proibida em vários países (Coterc, 2008). Sabe-se que a espécie ocorre em baixas densidades (Oliveira *et al*., 2010), mas ainda possui duvidosa estimativa populacional e possíevel tendência de declínio no número de indivíduos (Almeida *et al*., 2013).

Figura 3 - Distribuição conhecida do jaguarundi (Fonte: IUCN).

3.3. O leopardo (*Panthera pardus*) (Linneaus, 1758)

O leopardo é o maior felino selvagem pintado da África e Ásia (Sunquist & Sunquist, 2002) e uma das menores espécies do atual gênero *Panthera* (Davis *et al.*, 2010; Tseng *et al.*, 2013). Os aspectos principais da biologia da espécie são bastante similares aos da onça-pintada em relação aos hábitos e dieta (predadores oportunistas, preferencialmente noturnos e possuindo uma vasta gama de presas, com destaque para mamíferos de pequeno e médio porte [Kingdon, 2001]).

A espécie possui maior distribuição geográfica do que qualquer outra espécie de felino. Pode ser encontrado desde o extremo leste da Rússia até a África, compreendendo o território de mais de 35 países (Figura 4). Leopardos foram registrados nos últimos 25 anos no sul da África (Balme *et al*., 2010; Balme *et al*., 2013; Swanepoel *et al*., 2013), África Central (Henschel & Ray, 2003; Patterson *et al*., 2004; Ray *et al*., 2005), Península Arábica (Perez *et al*., 2006; Mazzolli, 2009), India (Ramakrishnan *et al*., 1999; Johnsingh & Negi, 2003; Chauhan *et al*., 2005; Harihar *et al*., 2011; Dutta *et al*., 2012; Dutta *et al*., 2013), Ásia Central (Khorozyan, 2000; Khorozian, 2003; Sanei, 2007; Gavashelishvili & Lukarevskiy, 2008; Ghoddousi *et al*., 2008; Waseem, 2010; Taghdisi *et al*., 2013), Nepal (Ghimirey, 2006; Thapa *et al*., 2013), Butão (Sangay & Vernes, 2008; Wang & Mcdonald, 2009I; Wang & Mcdonald, 2009II), Sri Lanka (Miththapala *et al*., 1989; Kittle & Watson, 2009), sudeste Asiático (Kawanishi *et al*., 2010; Sanei *et al*., 2011; Gray & Prum, 2011), Rússia (Hebblewhite *et al*., 2011), China (Jutzeler *et al*., 2010) e Java, Indonésia (Meijaard, 2004). Pode ser encontrado em altitudes que variam desde o nível do mar até 5.000m (Sunquist & Sunquist, 2002). Atualmente, a espécie está dividida em nove subespécies válidas, as quais são base para estudos diversos, bem como para estratégias de conservação (Uphyrkina *et al*., 2001; Henschel *et al*., 2013).

Uma grande variedade de hábitats está associada com a presença de leopardos: ambientes florestais densos, florestas frias, campos, savanas, regiões rochosas, semiáridas e desérticas. Suas áreas de vida ocupam grandes extensões territoriais, tal como ocorre com outros felinos de grande porte (Sunquist & Sunquist, 2002). Além de prováveis diferenças demográficas intrínsecas à espécie em diferentes ambientes, efeitos antropogênicos levaram à redução recente do número de leopardos em distintas regiões, acarretando em variação geográfica na sua densidade populacional (Kingdon, 2001).

O leopardo encontra-se categorizado como 'quase ameaçado' na lista vermelha das espécies ameaçadas da IUCN e, em alguns locais de sua distribuição como Rússia, China e Java é criticamente ameaçado pelo fato de as populações estarem isoladas, com pequeno tamanho efetivo e baixo número de indivíduos (Henschel *et al*., 2013). Além disso, também está listada no apêndice I da CITES por conta de redução e fragmentação do seu habitat e pressões de caça (comum em diversos países devido a confrontos com atividades humanas, já que frequentemente preda animais domésticos [Sunquist & Sunquist, 2002; Azlan & Sharma, 2006; Henschel *et al*., 2013]). Seu status populacional é desconhecido na maior parte de sua distribuição, mas estima-se que a tendência geral da espécie seja o declínio (Henschel *et al*., 2013).

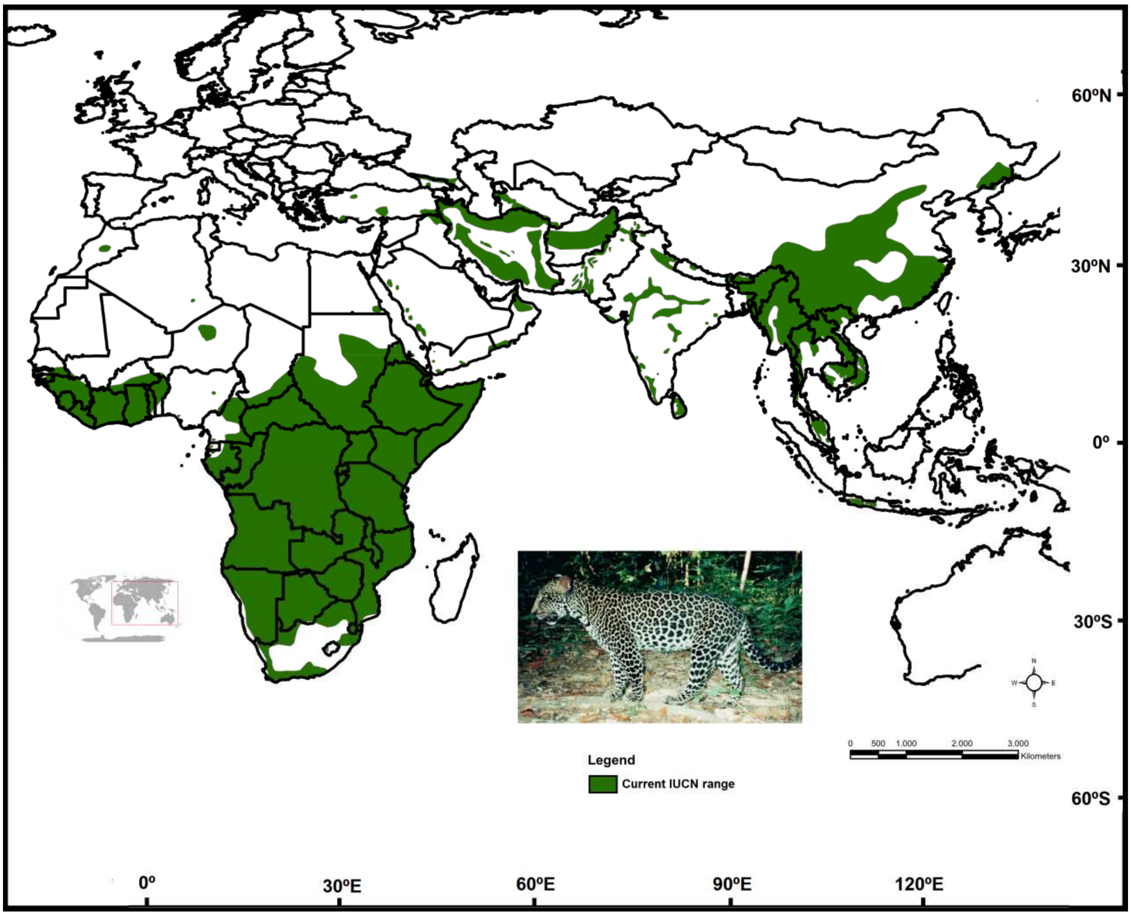


Figura 4 - Distribuição conhecida do leopardo (Fonte: IUCN).

4. Modelagem de distribuição de espécies como ferramenta para estudos de ecologia, conservação e evolução

Com o crescimento da pesquisa científica na área da Ecologia, o desenvolvimento tecnológico (especialmente computacional) e a utilização de métodos baseados em sistemas de informações geográficas (SIG's) novas técnicas vêm sendo incorporadas aos projetos, com destaque para as últimas duas décadas (Turner *et al*., 2003; Rangel & Loyola, 2012; Joppa *et al*., 2013). Ao mesmo tempo em que cresce a utilização de ferramentas computacionais e o desenvolvimento de novos algoritmos de análises de dados, cresce também a pressão sobre os recursos naturais, mudanças climáticas no planeta e a taxa de modificação das paisagens originais. Portanto, entender como são os padrões de distribuição natural dos organismos e como essas modificações antrópicas os afetam são questões-chave para estudos de evolução e para a biologia da conservação na atualidade (Whittaker *et al*., 2005; Kozak *et al*., 2008; Marco Jr. & Siqueira, 2009; Costa *et al*., 2010; Wiens *et al*., 2010). Além disso, o aumento dos registros de ocorrência das espécies em bases de dados acessíveis para o público geral são o pilar de um novo campo chamado "eco-informática" que é a base para os atuais modelos de nicho ecológico (Paterson *et al.,* 2011; Diniz-Filho & Loyola, 2012).

Conhecer a distribuição geográfica das espécies é uma das questões fundamentais da ecologia geral visando ao entendimento de como parâmetros ambientais influenciam os padrões de biodiversidade. Para um ecólogo moderno, a história biogeográfica desses padrões, a estrutura da comunidade de estudo e os processos ecológicos capazes de criá-los são os mais importantes fatores para a compreensão de onde uma espécie se distribui e porque ela encontra-se naquele ambiente (Wiens & Donoghue, 2004). As espécies persistem em locais onde toleram fatores ambientais bióticos e abióticos (nicho ecológico) e muitos dos padrões biogeográficos conhecidos são criados por essas diferenças de nicho (Wiens, 2011; Rangel & Loyola, 2012; Wisz *et al*., 2013).

A modelagem de nicho ecológico ou modelagem de distribuição de espécies é definida como a inferência ou previsão da distribuição geográfica de determinado organismo por meio de métodos ou algoritmos (Guisan & Zimmermann, 2000; Colwell & Rangel, 2009; Franklin, 2009; Peterson & Soberón, 2012), sendo uma ferramenta comum nos estudos recentes de biogeografia e ecologia (Calabrese *et al*., 2013). São cinco os tópicos a serem considerados de grande importância para os modelos de distribuição de espécies: o conceito fundamental de nicho ecológico, o delineamento amostral e constituição da modelagem, parâmetros ou preditores que serão utilizados, seleção do modelo, contribuição dos preditores e avaliação do modelo final (Araujo & Guisan, 2006). Todas essas considerações visam à melhoria da capacidade de prever com precisão a distribuição observada das espécies.

Uma das questões mais importantes nos modelos de nicho ou de distribuição de espécies é a gama de métodos ou algoritmos potencialmente úteis (Rangel & Loyola, 2012). Existem três grupos de métodos principais que podem ser utilizados para modelagens de nicho ecológico. (I) Modelos "envelope" ou modelos de classificação: recomendáveis para estudos que a visam inferir a forma e direção da relação entre a ocorrência das espécies e condições ambientais. São modelos genéricos, de fácil compreensão e interpretação, que tendem a superestimar a distribuição. São exemplos de modelos de classificação o BIOCLIM (Busby, 1991), o *Euclidian and Gower Distances* (Carpenter *et al*., 1993) e o ENFA (*Ecological-Niche Factor Analysis*) (Hirzel *et al*., 2002). (II) Modelos estatísticos baseados em regressão: possuem melhor aplicabilidade se a ocorrência das espécies responde linearmente às mudanças ambientais ou incorpora consequências da interação de fatores ambientais e a distribuição. São modelos de complexidade intermediária, de compreensão relativamente fácil e com melhor resultado de predição do que os modelos de classificação. São exemplos de modelos de regressão o GAM (*Generalized Additive Model*) (Hastie & Tibshirani, 1986), o MARS (*Multivariate Adaptive Regression Splines*) (Friedman, 1991) e o GLM (*Generalized Linear Models*) (Guisan *et al*., 2002). (III) Modelos de aprendizagem automática ('*machine-learning*'): são modelos de alta complexibilidade, alta precisão e grande robustez estatística. São muito efetivos para predições pois maximizam a relação entre a ocorrência e os preditores, porém apresentam problemas quando são utilizados com um número grande de parâmetros e estes possuem correlação entre si (Olden *et al*., 2008). Como exemplos podem ser citados: GARP (*Genetic Algorithm for Rule Set Production*) (Stockwell & Noble, 1992), ANN (*Artificial Neural Networks*) (Manel *et al*., 1999), *Random Forests* (Breiman, 2001), *Generalized Boosting Regression Model* (Friedman, 2001) e o Maxent (*Maximum Entropy*) (Phillips *et al*., 2006).

Dentre os mais complexos modelos de distribuição de espécies, um dos métodos mais populares e mais utilizados atualmente é o Maxent, o qual conta com mais de 1000 aplicações publicadas desde sua criação (Elith *et al*., 2010; Loiselle *et al*., 2010; Terribile *et al*., 2010; Merow *et al*., 2013). O modelo é baseado no algoritmo de aprendizagem automática de máxima entropia descrito por Philips *et al*. (2006) e utiliza como base a combinação de pontos de presença das espécies com parâmetros preditivos. Seu desempenho é influenciado pelo número de parâmetros utilizados e o potencial de acerto do modelo é avaliado estatisticamente pela AUC (*area under curve*) do método ROC (*receiver operating characteristic*) (Philips & Dudik, 2008). É atualmente considerado o melhor método para modelar uma distribuição geográfica desconhecida de determinada espécie (Elith *et al*., 2010; Rangel & Loyola, 2012).

Em suma, esses diversos modelos de distribuição de espécies e especialmente o Maxent podem ser utilizados em uma gama de temáticas distintas, por exemplo em efeitos e respostas a mudanças climáticas (Buckley *et al*., 2010; Lawing & Polly, 2011;

Simon *et al*., 2013), reconstrução de histórias demográficas (Collevatti *et al*., 2012), paleodistribuição (Ribeiro & Diniz-Filho, 2012; Collevatti *et al*., 2013), estudos de endemismo (Carnaval & Mortiz, 2008), inferência de refúgios (Waltari *et al*., 2007; Thomé *et al*., 2010), predição da riqueza de espécies (Graham & Hijmans, 2006), estimativa da distribuição atual de diversos grupos de organismos (Hernandez *et al*., 2006; Buermann *et al*., 2008; Kumar & Stohlgren, 2009; Raes *et al*., 2009; Loiselle *et al*., 2010; Warren *et al*., 2011), inclusive com aplicação para espécies de felídeos (Mukherjee *et al*., 2010; Ferraz *et al*., 2012; Tôrres *et al*., 2012) e até mesmo testes do desempenho dos modelos comparativamente (Elith *et al*., 2006), dentre outros. Além disto, responder outros tipos de perguntas biológicas (tal como determinar a distribuição geográfica de características intraespecíficas e explorar sua relação com variáveis ambientais) pode ser uma nova abordagem para esses métodos. Entender a teoria por trás dos modelos de distribuição, utilizar dados e métodos apropriados, testar a performance preditiva dos modelos e aplicá-los para responder questões biológicas (Pearson, 2007) é o desafio para sua utilização em projetos de ecologia, evolução e conservação.

5. Objetivos

5.1. Objetivo geral

Caracterizar os padrões de distribuição espacial do melanismo em *Panthera onca*, *Panthera pardus* e *Puma yagouaroundi*, visando investigar a relevância adaptativa deste fenótipo em populações naturais.

5.2. Objetivos específicos

1. Gerar um banco de dados georreferenciado contendo pontos de ocorrência de indivíduos das três espécies em questão (incluindo capturas de animais vivos, imagens de armadilhas fotográficas, peles depositadas em coleções científicas e amostras de DNA fecal) para os quais o melanismo possa ser claramente identificado.

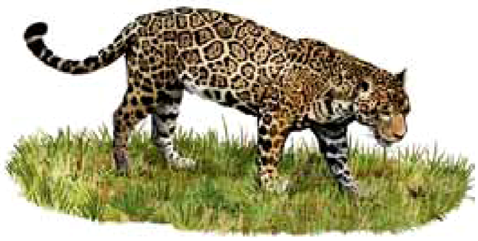
2. Mapear a ocorrência geográfica do melanismo nas três espécies de interesse.

3. Testar se a ocorrência do melanismo nessas espécies é aleatória ou se está associada a diferentes biomas ou ecoregiões.

4. Estimar um modelo de nicho ecológico para a distribuição geográfica de cada uma das espécies, bem como a ocorrência de melanismo nas mesmas, considerando parâmetros ambientais preditores.

5. Investigar a relação entre a distribuição dos fenótipos de coloração nestas espécies e variáveis ambientais, buscando identificar indícios de processos biológicos envolvidos na atuação de seleção natural sobre esta característica.

CAPÍTULO 2:



ARTIGO CIENTÍFICO

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A ser submetido para a revista 'Global Ecology and Biogeography'

A BIOGEOGRAPHIC ASSESSMENT OF JAGUAR (*Panthera onca*) MELANISM: NICHE MODELING REVEALS A NON-RANDOM DISTRIBUTION ACROSS DIFFERENT LANDSCAPES

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ABSTRACT

Aim The exact geographic distribution, ecological relevance and adaptive role of phenotypic polymorphisms are still poorly known for most organisms. Among felids, melanism is a well-known polymorphism affecting the coat color of several species. Although such variation has been known for over a century, and speculations regarding its adaptive relevance are equally old, so far this polymorphism has not been thoroughly investigated, to the extent that not even its exact biogeographic occurrence is documented in any cat species. In this study, we aimed to characterize the geographic distribution of melanism in jaguars and test whether such phenotypic variant was distributed randomly across the species' range, or associated with particular landscape conformations.

Location The New World.

Methods We built a database of jaguar location points originating from camera-traps, field captures, fecal DNA samples and records in scientific collections, identifying melanistic *vs.* non-melanistic individuals. We produced models of the geographic distribution pattern of melanism in jaguars using niche modeling algorithms and environmental predictors with the Maxent software. Additionally, we analyzed the frequency of melanism in biomes and ecoregions using our location record database and statistical comparisons among landscape conformations.

Results We assembled 794 jaguar records, of which 765 possessed coat color information. The overall frequency of melanism was *ca.* 9%, and the occurrence of this phenotype was not randomly distributed across the species' range. In forested areas, a stronghold of jaguars and a type of habitat that could possibly favor melanism, the frequency of this variant did not depart from the overall mean. In contrast, seasonally flooded areas (Pantanal and Llanos) presented no records of melanism, leading to a significantly lower frequency than the expectation based on the overall mean. Interestingly, in dry open landscapes (savannas and grasslands), the frequency of melanism was higher than expected, but this deviation may have been mostly influenced by local demographic factors in sampled areas.

Main conclusions Our spatial analyses provided an improved map of the jaguar geographic distribution, and the first detailed map of the occurrence of melanism in this species. We demonstrate that melanism, although widespread, was not distributed randomly across different biomes. Rather, this variant was overrepresented in some habitats and absent in others, indicating that natural selection could be acting upon this phenotype. In the case of the Pantanal and Llanos, this inference is further supported by the available evidence of geographic proximity and historical connectivity with adjacent biomes in which melanism is present. Niche modeling analyses allowed the direct assessment of environmental variables as predictors of the presence of melanism, and suggested that parameters associated with moisture, temperature and solar radiation may influence the spatial distribution of this mutant phenotype.

INTRODUCTION

The adaptive relevance of animal coloration has been explored and discussed for over a century (e.g. Gloger, 1833; Poulton 1890, Beddard 1895, Cott 1940). Pigmentation phenotypes have often been inferred to present adaptive roles in ecological, physiological and/or behavioral processes such as camouflage, intra- and interspecific communication, and thermoregulation (Beddard, 1895; Cott, 1940; Majerus, 1998; Caro, 2005). The broad phenotypic variation of vertebrates observed in nature is one of the questions that have long intrigued evolutionary biologists, including its adaptive significance and genetic basis. Despite the interest in the subject, relatively few studies have addressed the association between phenotypes in natural populations and the environments in which organisms occur, aiming to investigate evolutionary processes involved in the generation and maintenance of coloration diversity and the environmental characteristics that influence the adaptive significance of phenotypes (Eizirik & O'Brien 2003; Nachman *et al.*, 2003; Hoekstra 2006).

Melanism is a color polymorphism that is common in various groups of organisms, in which the skin/fur/plumage is darker than what would be considered the normal or 'wild' phenotype. There are classical hypotheses that postulate an adaptive role of melanism in different species, involving many potential impacts on survival or reproduction (e.g. Cott, 1940; Ortolani & Caro, 1996; Majerus, 1998; Caro, 2005).

Several biological factors such as thermoregulation, susceptibility or response to disease, camouflage, aposematism, sexual selection and reproductive success could be directly influenced by melanism, but in most cases such possibilities have not yet been rigorously tested (Majerus, 1998).

The occurrence of melanism is rather common in the Felidae, having been documented in 13 of the 38 species of the group (Schneider *et al.*, 2012). Interestingly, in none of them has it reached fixation, but rather always exists as a polymorphic phenotype. Recent analyses have shown that melanism evolved independently at least eight times within the Felidae (Eizirik *et al.* 2003*;* Schneider *et al.*, 2012; Schneider 2013), in some cases reaching very high frequencies in natural populations (e.g. Kawanishi *et al.*, 2010). These observations support the hypothesis that melanism can provide an adaptive advantage in certain ecological conditions (Caro, 2005; Allen *et al.*, 2010).

The biological effects and even the geographic distribution of coloration variants are not clearly known at this time, making it difficult to carry out systematic or rigorous tests of this adaptive hypothesis. Early work on this topic raised the hypothesis of an association between darker individuals and wetter areas with dense vegetation (e.g. tropical forests) (Gloger, 1833; Cott, 1940; Ulmer, 1941; Ortolani & Caro, 1996). In addition, there have also been suggestions of the potential for negative selection against dark individuals in open areas where the sunlight/radiation levels and mean temperatures are high (Ulmer, 1941; Ortolani & Caro, 1996; Majerus, 1998; Majerus & Mundy, 2003). Although these hypotheses have been commonly mentioned in the technical literature as anecdotal postulates, and also appeared in the popular culture for some time, they have never been directly tested.

The jaguar (*Panthera onca*) is the largest wild cat in the Americas, and the only extant representative of genus *Panthera* in the New World (Sunquist & Sunquist, 2002). Its current distribution stretches over 18 nations, from the southern United States to Argentina (Sanderson *et al.*, 2002). The species is listed on Appendix 1 of CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora) (Hatten *et al*., 2005) and is considered vulnerable by the IUCN (Wozencraft, 1993; Caso *et al*., 2014) due by habitat loss, fragmentation and human persecution (Eizirik *et al.*, 2001; Carvalho Jr. & Morato, 2013; Morato *et al*., 2013). In addition, some remaining populations may be critically endangered and are isolated and with low number of individuals (Eizirik *et al.*, 2001; Haag *et al.*, 2010a; Galetti *et al.*, 2013).

Melanism in jaguars (Figure 1) is inherited as a dominant trait, caused by a 15-base-pair deletion in the *MC1R* gene that leads to a "gain of function" mutation favoring the production of dark melanin (eumelanin) in the background regions of the coat (Eizirik *et al.*, 2003; Haag *et al*., 2010b). Although the trait has been well known in this species for many years and easily identifiable in jaguars in nature (e.g. Nelson & Goldman, 1933; Ulmer, 1941; Robinson, 1976; Dittrich 1979), its geographic distribution, as well as the environmental factors that may influence its persistence in natural populations, are still unknown.

In this study we aimed to develop spatial distribution models of melanism in *P. onca* in response to environmental parameters obtained from global databases and/or remote sensing, to evaluate the adaptive relevance of this phenotype in jaguars. We consider and test two alternative hypotheses: (1) melanism is present throughout the species' distribution, occurring randomly across all environments (i.e. absence of association with different landscape conformations); and (2) melanism is distributed according to environmental parameters and biogeographic constraints. Additionally, we seek to identify environmental variables that may be associated with the presence or absence of melanism in a particular ecoregion, aiming to draw inferences on the occurrence of natural selection acting on these phenotypes.

METHODS

Species data

The data set comprised record points from the entire historical range of the jaguar, from the southern United States to Argentina (Table 1, Figure 2), encompassing various biomes (e.g. moist and dry forests, grasslands and desert areas). These records were obtained from five different sources: (1) individuals kept in scientific collections that possessed information on the geographic coordinates of the sampling location as well as on coat color (or, preferably, available skin for direct assessment and photographic documentation of coat color); (2) Individuals captured or found dead during field ecology studies; (3) field-collected faecal samples whose melanism status could be confidently inferred using a molecular assay (Haag *et al.*, 2010b); (4) camera trap records; and (5) samples available in online databases with precise geographic origin and available source information (e.g. Global Biodiversity Information Facility - GBIF.org).

Environmental predictors

The occurrence of different phenotypes throughout the species' distribution was mapped by building a database of location records of melanistic and non-melanistic individuals using ArcGis 9.3 (ESRI, 2010). All the records were converted into degree coordinates, using the *WGS84* standard reference system. Additionally, we used biome and terrestrial ecoregion shapefiles (Olson *et al.*, 2001) as mask layers, to extract and analyze information about natural landscapes in which the phenotypes occur.

For modeling the potential distribution of melanism, in the initial analysis we considered 37 explanatory environmental variables and landscape data that covered 100% of the jaguar's known distribution. We used 35 environmental variables obtained from the Worldclim (http://www.worldclim.org) and Climond (http://www.climond.org) databases: annual mean temperature (Bio01), mean diurnal temperature range (Bio02), isothermality (Bio03), temperature seasonality (Bio04), max temperature of warmest week (Bio05), min temperature of coldest week (Bio06), temperature annual range (Bio07), mean temperature of wettest quarter (Bio08), mean temperature of driest quarter (Bio09), mean temperature of warmest quarter (Bio10), mean temperature of coldest quarter (Bio11), annual precipitation (Bio12), precipitation of wettest week (Bio13), precipitation of driest week (Bio14), precipitation seasonality (Bio15), precipitation of wettest quarter (Bio16), precipitation of driest quarter (Bio17), precipitation of warmest quarter (Bio18), precipitation of coldest quarter (Bio19), annual mean radiation (Bio20), highest weekly radiation (Bio21), lowest weekly radiation (Bio22), radiation seasonality (Bio23), radiation of wettest quarter (Bio24), radiation of driest quarter (Bio25), radiation of warmest quarter (Bio26), radiation of coldest quarter (Bio27), annual mean moisture index (Bio28), highest weekly moisture index (Bio29), lowest weekly moisture index (Bio30), moisture index seasonality (Bio31), mean moisture index of wettest quarter (Bio32), mean moisture index of driest quarter (Bio33), mean moisture index of warmest quarter (Bio34), and mean moisture index of coldest quarter (Bio35). In addition, we included data on altitude (obtained from the SRTM [http://www2.jpl.nasa.gov/srtm]) as well as on landscape surface cover (obtained from ESA GlobCover Project 2009 [http://due.esrin.esa.int/globcover]). All variables were used at a fine (~1 km) spatial resolution.

Since correlation among explanatory variables can lead to model overfitting, we computed Pearson's correlation coefficient (*r*) between each pair of variables (Kumar & Stohlgren, 2009; Raes *et al*., 2009; Mukherjee *et al*., 2010), using the SPSS 17.0 statistical software. The correlation was assessed by extracting variable information from 10,000 unique and randomly generated points within the present geographic distribution layer of jaguars (obtained from IUCN, and complemented with our own database records) using ArcGis 9.3. We selected 10 variables that were not highly correlated to each other, using *r*=0.7 as the cut-off value. The selected variables were: annual mean temperature, maximum temperature of warmest week, minimum temperature of coldest week, annual precipitation, precipitation of wettest week, precipitation of driest week, highest weekly radiation, lowest weekly radiation, annual mean moisture index and altitude (the latter one being included given the ecological relevance of this information). These predictors were then selected assuming that they are sufficient for modeling the geographic distribution of this species, and the distribution of melanism within it.

Modeling procedures

We modeled the overall distribution of jaguars and the spatial distribution of melanism using the maximum entropy algorithm implemented in the software Maxent (Phillips *et al*., 2006) along with associated statistical tools (Waltari *et al.*, 2007; Phillips & Dudik, 2008; Elith *et al*., 2010; Merow *et al.*, 2013). We employed the total set of records, 70% of which were used for training and 30% for testing the models. The data were sampled using the bootstrap routine of 10 random partitions with replacement (Pearson, 2007). All runs were configured in random seed, convergence threshold of 1E-5 with 500 iterations and 10,000 hidden background points (Ferraz *et al.*, 2012). Model performance was assessed by the AUC (Area Under Curve) value for the Receiver Operating Characteristic (ROC Curve) and the binomial probability (Pearson, 2007; Calabrese *et al*., 2013), aiming to obtain models of continental-scale distribution and description of environmental parameters which are related to the spatial distribution of melanism. We also observed a complete lack of melanistic records in the Llanos ecoregion of Colombia and Venezuela, in spite of reasonable coverage of our sampling in that area (see Table 2). Given these observations, we decided to perform additional analyses of landscape variables and their association with melanism with a specific focus on these ecoregions. Finally, four models were run with this configuration (see Results for more details on model choice): (1) the total set of 794 samples (control model), (2) the 69 melanistic animals (melanism model), (3) the 79 records from the Pantanal; and (4) the 29 records from the Llanos.

Statistical analysis

The statistical analysis of record distribution for each biome was done using the chi-square test with Fisher correction (Plackett, 1983). The basic approach was to test differences between the observed and expected frequencies of melanism for each landscape conformation. The correction test was justified because in some biomes (35.7% of the total) we had fewer than five samples for one group in a single category, which violates assumptions of the standard chi-square test. As there was no detected bias with respect to the sampling of different phenotypes at any location (i.e. our sampling was random in regard to coat color), we used the overall frequency of melanism across the whole range (based on the 765 records containing coat color information) to generate the expected number of melanistic records per biome. We used this approach to test two competing hypotheses regarding the association between phenotypic groups and biomes/ecoregions: (1) the null hypothesis that observed frequencies of melanistic and non-melanistic animals are not different from the expected frequencies in each habitat, resulting in no association between melanism and any biome; and (2) the alternative hypothesis that observed frequencies are different from expected frequencies in each biome, suggesting an association between these two groups and the landscapes in which the animals are included.

RESULTS

We obtained 794 samples, 696 of which were non-melanistic individuals, 69 were melanistic animals and 29 had no information on coat color (Table 1, Figure 2, and Supplementary Table 1). In addition to our analyses focusing on melanism, this database contributed to update the currently accepted distribution of jaguars (based on Sanderson *et al.* [2002]; Rabinowitz & Zeller [2010]), filling geographic gaps where this species had not been recorded previously but was thought to potentially occur (Morato *et al*., 2013).

The overall frequency of melanism was 9% across the species' range. Most of the records of melanistic animals (66 in total) were located in South America. Moreover, all regions that had previously been reported as potential sites of melanistic jaguar occurrence in different biomes of Brazil were corroborated by this study, especially the Amazon and Cerrado areas (states of Amazonas, Pará, Mato Grosso, Goiás and Minas Gerais; see Meyer [1994]) and Caatinga (Serra da Capivara National Park [Perez, 2008; Silveira *et al*., 2009]). Additionally, new records in our database were obtained for areas where there were no previous reports of melanistic animals (Colombia, Peru, Ecuador) (Figure 2). In some cases, melanism can reach high frequencies in a single ecoregion, for example the Alto Paraná Atlantic Forest, Cerrado and Caatinga ecoregions (Table 2).

When the presence of melanism across regions was assessed, we observed marked differences in its frequency among distinct landscape conformations (biomes and ecoregions, Tables 2 and 3). In particular, there was a significant ($P<0.05$) excess of melanistic animals in our sample of records from the Caatinga biome in Brazil, and a complete lack of melanism in the Pantanal (implying a significantly [$P<0.05$] lower frequency of this phenotype in this region).

Niche models generated here were considered satisfactory (AUC $\geq$ 0.9): control model (AUC training = 0.949, test = 0.941), melanism (AUC training = 0.978, test = 0.955), Pantanal (AUC training = 0.979, test = 0.996) and Llanos (AUC training = 0.989, test = 0.987). The control model provided a good fit to known present broad distribution model for jaguars in the Americas (Figure 3A), indicating that it provides a suitable baseline against which to compare the melanism model. The melanism model (Figure 3B) showed some similarities with the control model, but also some important differences, especially the low suitable habitats for occurrence in the Pantanal and Llanos ecoregions. There were also differences (not shown) in the two ecoregion-specific models (Pantanal and Llanos), which were used to assess the impact of different environmental variables on the presence (or absence) of melanism.

When we compared the four different niche models (Figure 4), we observed clear differences in the relative importance of at least three environmental predictors: annual mean temperature, lowest weekly radiation and min temperature of coldest week. These variables showed very distinct impacts on the predictive power of the melanism model when compared to the control (all samples) or to the two biomes in which melanism seems to be absent (see Figure 4).

DISCUSSION

Although jaguars are often documented in North and Central Americas (Sunquist & Sunquist, 2002), there were historically only three records of melanistic individuals in these regions. The only record of melanism from North America prior to this study was a black female photographed in 2004, in the El Fuerte River Valley, near Sinaloa, Mexico (Dinets & Polechla Jr., 2007). In Central America, there are two records of melanistic animals from Belize: Ek Balan and El Rancho Grande River (previously reported as possible by Meyer [1994]), both now confirmed. Remaining populations of the species have been recently identified in the northern portion of its distribution, in the southern United States (Grigione *et al.*, 2007; McCain & Childs, 2008), but there has been no record of melanism in these areas.

We generated in our study a model of the jaguar distribution that may be incorporated into additional assessments of its range for use in the design of conservation strategies for jaguars, as it presents distinct (and perhaps complementary) features when compared to the previous models generated by Ferraz *et al.* (2012) and Tôrres *et al.* (2012). Additionally, the location records from our database corroborate the observation that the species has lost part of its historical range, especially in the southern portion of Brazil (reported by Mazzoli [2008]) and in Florida, United States (reported by Daggett & Henning [1974]).

The combination of statistical techniques associated with geographic information systems data has been used for some time in predictive models of ecology (Guisan & Zimmermann, 2000) and especially in ecological niche models in the context of macroecological analysis (Carnaval & Moritz, 2008; Elith *et al.*, 2010; Loiselle *et al.*, 2010; Calabrese *et al*., 2013). The models shown in Figure 3 were designed to provide an analysis of the relative influence of environmental predictors on the geographic distribution of melanism in jaguars. The main differences between the control model, melanism model, and Pantanal and Llanos models were restricted particularly to three predictors: annual mean temperature, lowest weekly radiation and minimum temperature of coldest week (Figure 4). All of these predictors are possibly related with thermoregulation in natural habitats, suggesting that the presence (or frequency) of melanism in jaguars may be regulated by climatic variables. However, it is important to highlight that the relative importance of predictors assessed here is related only to their influence on each Maxent niche model (percent impact on the composition of each distribution map), i.e. the comparison was not performed on absolute values. In addition, we note that it is possible that some other important predictor (possibly bearing a causal influence on the observed pattern) may have been lost in the selection of variables by Pearson's test, or that another important predictor was not measured or contemplated in the initial analysis. Therefore, additional analyses of these data will be necessary to fully discern the underlying relationships between the incorporated variables and the resulting distributional pattern.

For a character to be recognized as adaptive, it must be derived and involved in the response to a selective agent (Futuyma, 2009), and in this context it is interesting to determine if a polymorphism deviates from equilibrium expectations (Kreitman, 2000). To elucidate biological issues related to melanism in natural populations, and assess the relevance of different adaptive phenotypes, it is necessary to consider the relative importance of genetic drift and natural selection on the dynamics of different phenotypes in distinct landscapes (Lande, 1976; Mukherjee *et al*., 2010). A selectively neutral phenotype should show a random pattern of variation among populations, while non-random patterns suggest the occurrence of selection (if populations are demographically connected). In the case of a stable polymorphism (such as melanism), an important issue to be considered is the phenotype frequency across different landscapes (Novembre & DiRienzo, 2009) because in some cases ecological variables describing a species range can predict genetic patterns (Mukherjee *et al*., 2010).

Previous studies have shown that jaguars possess low levels of geographic structure on a range-wide scale (Eizirik *et al*., 2001). Phylogeographic analyses indicated that there were no impassable historical barriers to gene flow throughout the species' range. Only a few historical barriers to dispersal were inferred at this scale, such as the Amazon River, whose influence was much stronger on the female-inherited mitochondrial DNA than on nuclear markers (implying some continuous male-mediated gene flow). These results suggested that the species has behaved historically almost as a panmictic population, which argues against the possibility that founder effects and/or high genetic drift at a regional scale could have induced the observed non-random patterns in the distribution of melanism. Also, there is so far no evidence of historical bottleneck events (Eizirik *et al*., 2001), which could have exacerbated genetic drift and thus lead to large-scale increases in the frequency of a neutral allele such as that involved in melanism. In this context, it may be noted that melanism is present with high suitability on both sides of the Amazon River, suggesting that it has not been affected by the historical (albeit incomplete) restriction to gene flow inferred with molecular markers. Given these considerations, we conclude that the most probable scenario is the jaguar melanism allele arose at a particular location and dispersed throughout the species' distribution, with its regional frequency being influenced at least partially by natural selection related to environmental parameters that vary across different landscapes.

We thus believe that the geographic variation observed here provides evidence for the existence of natural selection in this system, and provides some hints as to its nature. The most intriguing pattern observed here is the absence of melanistic jaguars from the Pantanal (Brazil) and the Llanos (Colombia/Venezuela), both of which comprise seasonally flooded savannas. It is relevant to mention that the Pantanal ecoregion harbors one of most studied and most stable natural populations of jaguars, with high abundance of individuals (estimated at 1000 jaguars, according to Morato *et al*. [2013]) and reasonably well preserved natural habitats (Soisalo & Cavalcanti, 2006; Cavalcanti & Gese, 2009). Even so, no current or historical records of melanism were found in this landscape conformation (in a set of 79 samples). Although the sample for the Llanos was not as extensive (29 records), the same pattern was observed in that ecoregion. Moreover, the niche modeling results pointed to very large differences in the distribution suitability between the melanism model in Pantanal and Llanos, when compared to the control model for the same regions (Figure 3). These results indicate that some feature(s) present in these ecoregions induce a lower suitability for the occurrence of jaguar melanism, given the available evidence that they are genetically and demographically connected to adjacent areas (e.g. Cerrado, Atlantic Forest, Amazon).

When rainforests were assessed, such as the Amazon and the Atlantic Forest, the frequency of melanism was exactly the same as that found for the species as a whole (9.0%, table 3). At the same time, the species potential distribution map and melanism distribution map indicates a high habitat suitability in bush and moist areas. As we know, the Amazon region has a large size and high population density of jaguars and can be considered a core habitat for the species (Tobler *et al*., 2013). In addition, the Brazilian Atlantic Forest region, despite the recent population decline (Paviolo *et al.*, 2008; Galetti *et al*., 2013) and the local loss of genetic diversity in jaguars (Haag *et al.*, 2010a), still has remaining populations. The presence of melanism in Brazilian forests had already been documented by Cullen Jr *et al.* (2006), and can reach high local frequencies in some remnant areas, such as in the Morro do Diabo State Park, Alto Paraná ecoregion (São Paulo state, Brazil). An interesting fact to consider is that this ecoregion is geographically very close to Pantanal areas where melanism is totally absent. Moreover, Valdez (2010) identified molecular evidence of historical gene flow between jaguars in the Alto Paraná forests and those from the southern Pantanal populations, indicating that the melanism allele should indeed have reached the Pantanal over historical time, and reinforcing the hypothesis of natural selection against melanism in the latter area.

Unlike the biomes mentioned above, in which the melanism frequency is null or equal to the expected frequency, there were biomes in which the melanism frequency was higher than expected. In desert and xeric shrublands (especially the Caatinga ecoregion) and tropical grasslands and savannas (especially the Cerrado ecoregion), melanism reached frequencies of 28.9% and 12.4%, respectively. At first glance, these results can be considered suggestive for positive selection favoring melanism in these areas. However, considering the reports from previous studies focusing on these biomes (Silveira *et al*., 2009; Morato *et al*., 2013) and our own database, we note that these melanistic records are concentrated in protected areas, in which the landscape has not been modified by human activities over the last 50 years, differently from the surrounding unprotected matrix. Taking into account the fast rates of landscape modification in the past years, this result suggests that the observed high frequency of melanism in these protected areas could be a consequence of genetic drift in these populations, which may be completely isolated from other fragments and possess a small effective population size. Such a process has already been demonstrated for Atlantic Forest jaguars using molecular markers (Haag *et al.*, 2010a), and may underlie the high frequency of melanism observed in areas such as the Morro do Diabo State Park mentioned above.

CONCLUSIONS

Given the current genetic evidence indicating that jaguars have historically comprised a broadly connected population across its range, it would be expected to find a random distribution of melanism throughout this distribution if this variant was selectively neutral. Our results indicate that this is not the case. Although the observed cases of increased frequency of melanism (e.g. in the Caatinga ecoregion) may be indeed derived from recent, drift-induced shifts in frequency in locally isolated populations, such a scenario is unlikely in the case of the Pantanal and the Llanos. Given the magnitude of these regions, their estimated population of jaguars, and the evidence (at least for the Pantanal) of connectivity with adjacent biomes, we do not find support for a drift-based explanation for the observed pattern, and thus favor a scenario implying an effect of natural selection. In the case of these regions, such a conclusion would imply selection against melanism in these habitats, possibly related to thermoregulation issues. Moreover, the suitability maps generated here showed differences in the distribution of melanistic records relative to the overall control, and suggested that at least some of the underlying differences could be related to environmental parameters such as moisture, temperature, precipitation and solar radiation. Overall, this study contributed to address a question that has circulated anecdotally for almost 200 years in the scientific literature but remained untested in natural populations (Gloger, 1833; Poulton 1890, Beddard 1895, Cott 1940), and particularly in wild felids (Nelson & Goldman, 1933; Ulmer, 1941; Robinson, 1976; Dittrich 1979). In addition to providing the first geographic distribution map for melanism in jaguars, our results demonstrate that its distributional pattern is non-random, and support the hypothesis that natural selection is operating on this phenotype, opening up new avenues for investigating this polymorphism in this and other felid species.

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BIOSKETCH

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SUPPLEMENTARY MATERIAL

Supplementary table 1 - Location records for *Panthera onca* employed in this study (pdf).

***Apêndice 1**

TABLES

Table 1 – Sample distribution by continent and country.

Country	Total	Non-melanistic	Melanistic	No color
		South America		
Argentina	16	16	0	0
Bolivia	22	18	1	3
Brazil	390	324	57	9
Colombia	121	118	2	1
Ecuador	13	10	1	2
French Guyana	15	15	0	0
Guyana	9	6	0	3
Paraguay	3	3	0	0
Peru	33	25	5	3
Suriname	2	1	0	1
Venezuela	11	8	0	3
SA Total	**635**	**544**	**66**	**25**
		Central America		
Belize	6	4	2	0
Costa Rica	7	6	0	1
Guatemala	88	88	0	0
Honduras	1	1	0	0
Nicaragua	4	4	0	0
Panama	5	5	0	0
CA Total	**111**	**108**	**2**	**1**
		North America		
United States	7	7	0	0
Mexico	41	37	1	3
NA Total	**48**	**44**	**1**	**3**
Total of samples	**794**	**696**	**69**	**29**

Table 2 – Number of records of melanistic and non-melanistic jaguar individuals in each of the sampled Neotropical biomes and ecoregions. Ecoregions listed in red font indicate the presence of melanistic individuals.

Biome	Ecoregion	Total Ecoregions S=Non-melanistic M=Melanistic	Total Biomes S=Non-melanistic M=Melanistic
Desert and Xeric Shrublands	Caatinga	27 (16S / 11M)	38 (27S / 11M)
	Central Mexican matorral	1 (1S)	
	Chihuahuan desert	4 (4S)	
	Guajira-Barranquilla xeric scrub	2 (2S)	
	Meseta Central matorral	1 (1S)	
	Sonoran desert	2 (2S)	
	Tamaulipan mezquital	1 (1S)	
Flooded Grasslands and Savannas	Pantanal	79 (79S)	79 (79S)
Temperate Grasslands, Savannas and Shrublands	Central forest-grasslands transition	1 (1S)	1 (1S)
Tropical and Subtropical Coniferous Forests	Central American pine-oak forests	3 (3S)	14 (14S)
	Sierra Madre del Sur pine-oak forests	2 (2S)	
	Trans-Mexican Volcanic Belt pine-oak forests	1 (1S)	
	Sierra Madre Occidental pine-oak forests	8 (8S)	
Tropical and Subtropical Dry Broadleaf Forest	Apure-Villavicencio dry forests	8 (8S)	44 (43S / 1M)
	Atlantic dry forests	2 (2S)	
	Chiquitano dry forests	19 (19S)	
	Sinaloan dry forests	9 (8S / 1M)	
	Sinú Valley dry forests	1 (1S)	
	Yucatán dry forests	3 (3S)	
	Sonoran-Sinaloan transition subtropical dry forest	2 (2S)	
Tropical and Subtropical Grasslands, Savannas and Shrublands	Beni savanna	1 (1S)	121 (106S / 15M)
	Cerrado	88 (73S / 15M)	
	Dry Chaco	2 (2S)	
	Humid Chaco	1 (1S)	
	Llanos	29 (29S)	
Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	92 (78S / 14M)	468 (426S / 42M)
	Bahia forests	7 (6S / 1M)	
	Caqueta moist forests	9 (9S)	
	Cauca Valley montane forests	4 (4S)	
	Central American Atlantic moist forests	3 (3S)	
	Chocó-Darién moist forests	3 (3S)	
	Cordillera Oriental montane forests	3 (3S)	
	Eastern Cordillera real montane forests	1 (1S)	
	Guianan Highlands moist forests	5 (5S)	
	Guianan moist forests	25 (23S / 2M)	
	Guianan savanna	1 (1S)	
	Iquitos varzeá	6 (6S)	
	Isthmian-Atlantic moist forests	7 (7S)	
	Isthmian-Pacific moist forests	4 (4S)	
	Japurá-Solimoes-Negro moist forests	6 (5S / 1M)	
	Madeira-Tapajós moist forests	9 (6S / 3M)	
	Magdalena Valley montane forests	12 (12S)	
	Magdalena-Urabá moist forests	19 (19S)	
	Marajó varzeá	2 (2S)	
	Maranhão Babaçu forests	1 (1S)	
	Mato Grosso seasonal forests	4 (4S)	
	Monte Alegre varzeá	1 (1S)	
	Napo moist forests	17 (16S / 1M)	
	Negro-Branco moist forests	15 (15S)	
	Northwestern Andean montane forests	7 (6S/1M)	
	Petén-Veracruz moist forests	93 (91S / 2M)	
	Purus varzeá	8 (4S / 4M)	
	Purus-Madeira moist forests	3 (1S / 2M)	
	Rio Negro campinarana	1 (1S)	
	Santa Marta montane forests	1 (1S)	
	Serra do Mar coastal forests	14 (14S)	
	Solimões-Japurá moist forests	7 (5S / 2M)	
	South American Pacific mangroves	1 (1M)	
	Southern Andean Yungas	1 (1S)	
	Southwest Amazon moist forests	28 (23S / 5M)	
	Talamancan montane forests	1 (1S)	
	Tocantins/Pindare moist forests	8 (8S)	
	Uatuma-Trombetas moist forests	14 (13S / 1M)	
	Ucayali moist forests	1 (1S)	
	Veracruz moist forests	4 (4S)	
	Xingu-Tocantins-Araguaia moist forests	4 (2S / 2M)	
	Yucatán moist forests	5 (5S)	
	Juruá-Purus moist forests	1 (1S)	
	Western Ecuador moist forests	4 (4S)	

Table 3 – Chi-square association test of landscape variables (biomes) with groups of samples (non-melanistic *vs.* melanistic). An adjusted residual <-2 or >2 indicates statistical significance for alpha=0.05.

Biome	Statistics	Groups		Total
		Non-melanistic	Melanistic	
Desert and Xeric Shrublands	Count	27	11	38
	Expected	34,6	3,4	38,0
	% within landscape	71,1%	28,9%	100,0%
	% within groups	3,9%	15,9%	5,0%
	% of Total	3,5%	1,4%	5,0%
	Adjusted Residual	-4,4	4,4	
Flooded Grasslands and Savannas	Count	79	0	79
	Expected	71,9	7,1	79,0
	% within landscape	100,0%	,0%	100,0%
	% within groups	11,4%	,0%	10,3%
	% of Total	10,3%	,0%	10,3%
	Adjusted Residual	3,0	-3,0	
Temperate Grasslands, Savannas and Shrublands	Count	1	0	1
	Expected	,9	,1	1,0
	% within landscape	100,0%	,0%	100,0%
	% within groups	,1%	,0%	,1%
	% of Total	,1%	,0%	,1%
	Adjusted Residual	,3	-,3	
Tropical and Subtropical Coniferous Forests	Count	14	0	14
	Expected	12,7	1,3	14,0
	% within landscape	100,0%	,0%	100,0%
	% within groups	2,0%	,0%	1,8%
	% of Total	1,8%	,0%	1,8%
	Adjusted Residual	1,2	-1,2	
Tropical and Subtropical Dry Broadleaf Forest	Count	43	1	44
	Expected	40,0	4,0	44,0
	% within landscape	97,7%	2,3%	100,0%
	% within groups	6,2%	1,4%	5,8%
	% of Total	5,6%	,1%	5,8%
	Adjusted Residual	1,6	-1,6	
Tropical and Subtropical Grasslands, Savannas and Shrublands	Count	106	15	121
	Expected	110,1	10,9	121,0
	% within landscape	87,6%	12,4%	100,0%
	% within groups	15,2%	21,7%	15,8%
	% of Total	13,9%	2,0%	15,8%
	Adjusted Residual	-1,4	1,4	
Tropical and Subtropical Moist Broadleaf Forest	Count	426	42	468
	Expected	425,8	42,2	468,0
	% within landscape	91,0%	9,0%	100,0%
	% within groups	61,2%	60,9%	61,2%
	% of Total	55,7%	5,5%	61,2%
	Adjusted Residual	,1	-,1	
Total	Count	696	69	765
	% within landscape	91,0%	9,0%	100,0%
	% within groups	100,0%	100,0%	100,0%
	% of Total	91,0%	9,0%	100,0%

Chi-square = 31.832, likelihood ratio = 34.993, Fisher's exact test = 30.051, standarized statistic -0.252. 765 valid cases.

FIGURE LEGENDS

Figure 1 – Main coat color variants in *P. onca*: (A) Non-melanistic (‘wild-type’) and (B) Melanistic. Photos: (A) Rony García-Anleu (Wildlife Conservation Society) and (B) Leandro Silveira (Jaguar Conservation Fund).

Figure 2 – Distribution of records in each sampled biome.

Figure 3 – Potential distribution map of jaguars: (A) Distribution of the species (control model) and (B) Distribution of melanism (melanism model).

Figure 4 – Relative importance (%) of the environmental predictors used in the Maxent models: Control model (yellow), Melanism (black), Pantanal-only (green) and Llanos-only (blue).

FIGURES

Figure 1

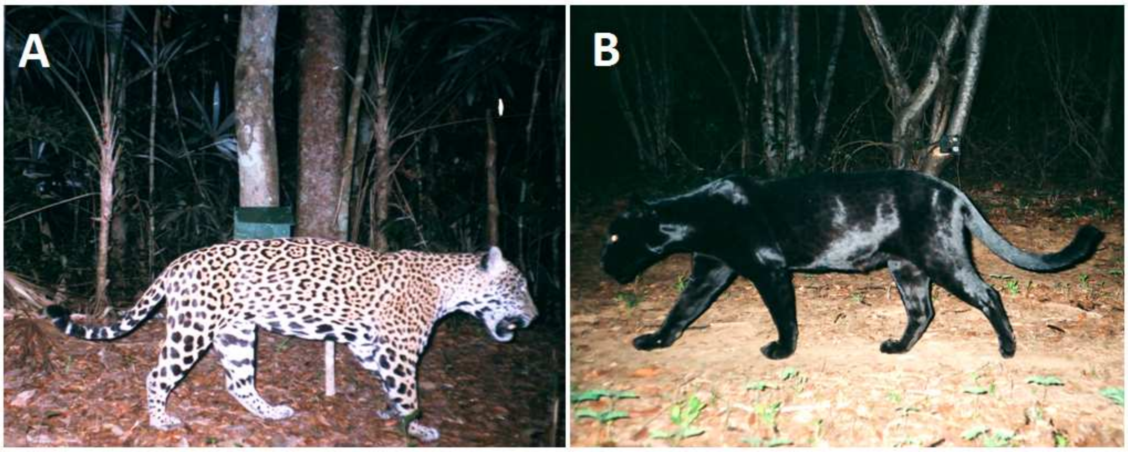
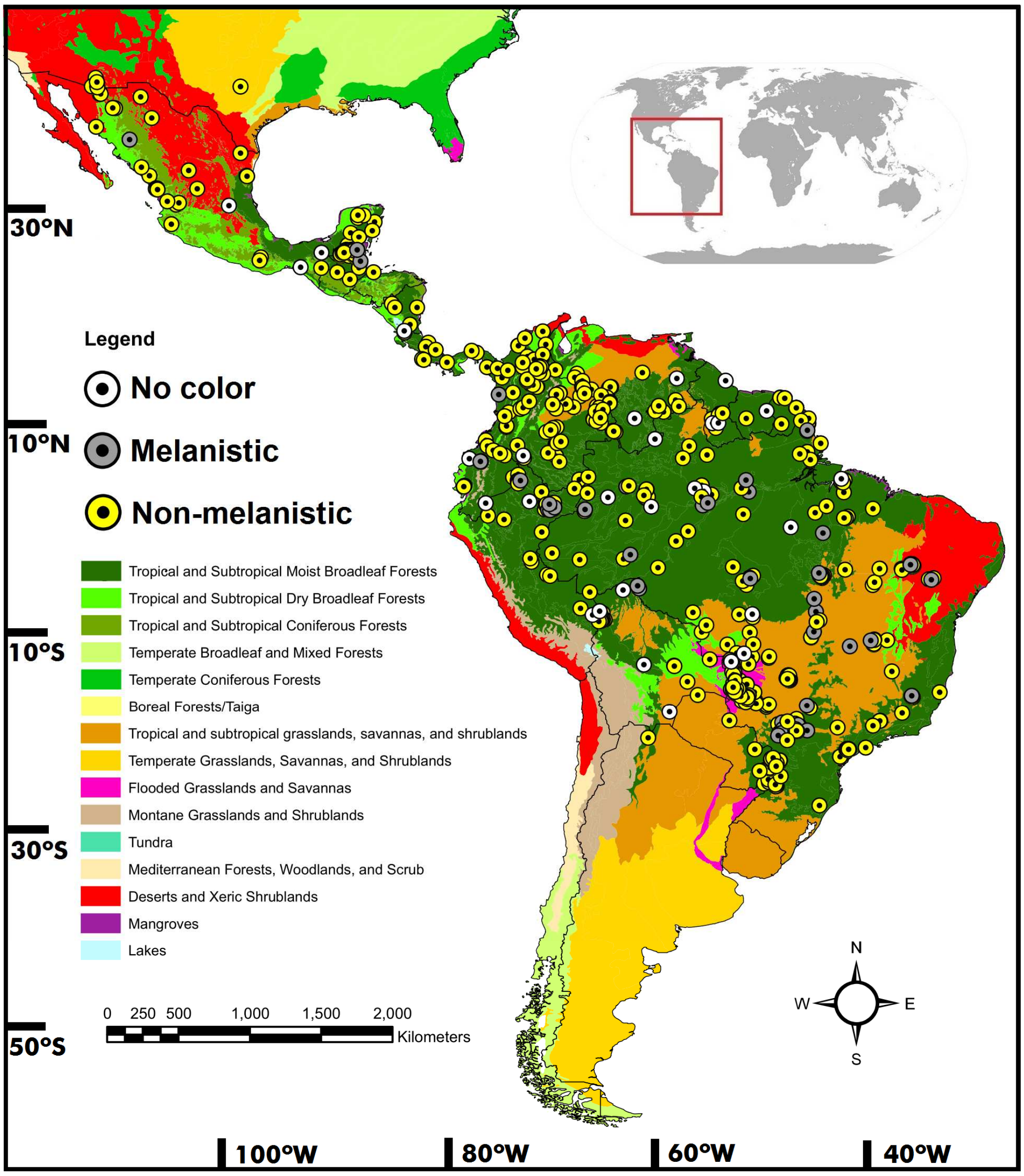


Figure 2



30°N
10°N
10°S
30°S
50°S
100°W
80°W
60°W
40°W
Legend
No color
Melanistic
Non-melanistic
Tropical and Subtropical Moist Broadleaf Forests
Tropical and Subtropical Dry Broadleaf Forests
Tropical and Subtropical Coniferous Forests
Temperate Broadleaf and Mixed Forests
Temperate Coniferous Forests
Boreal Forests/Taiga
Tropical and subtropical grasslands, savannas, and shrublands
Temperate Grasslands, Savannas, and Shrublands
Flooded Grasslands and Savannas
Montane Grasslands and Shrublands
Tundra
Mediterranean Forests, Woodlands, and Scrub
Deserts and Xeric Shrublands
Mangroves
Lakes
0 250 500 1,000 1,500 2,000
Kilometers
N
W
E
S

Figure 3

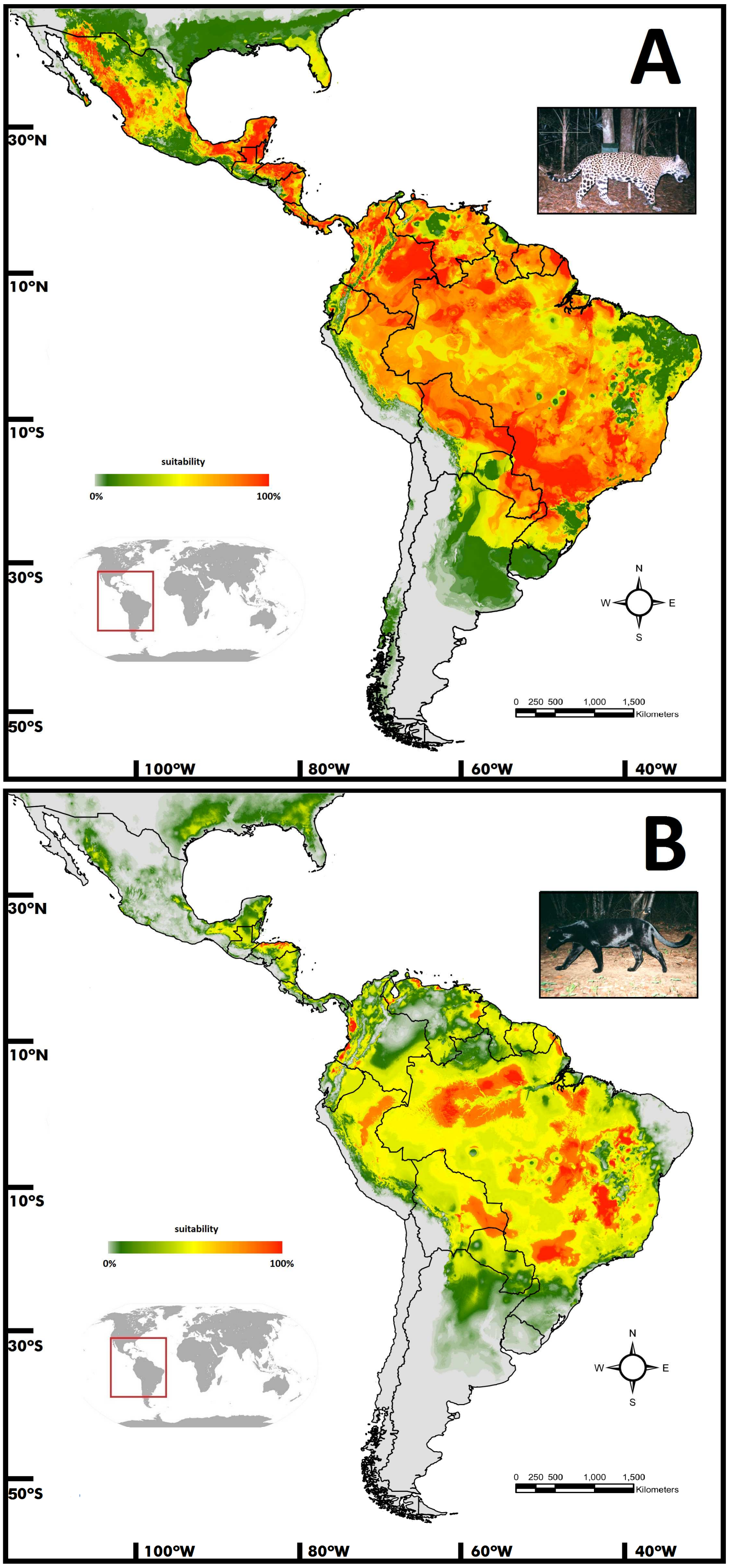
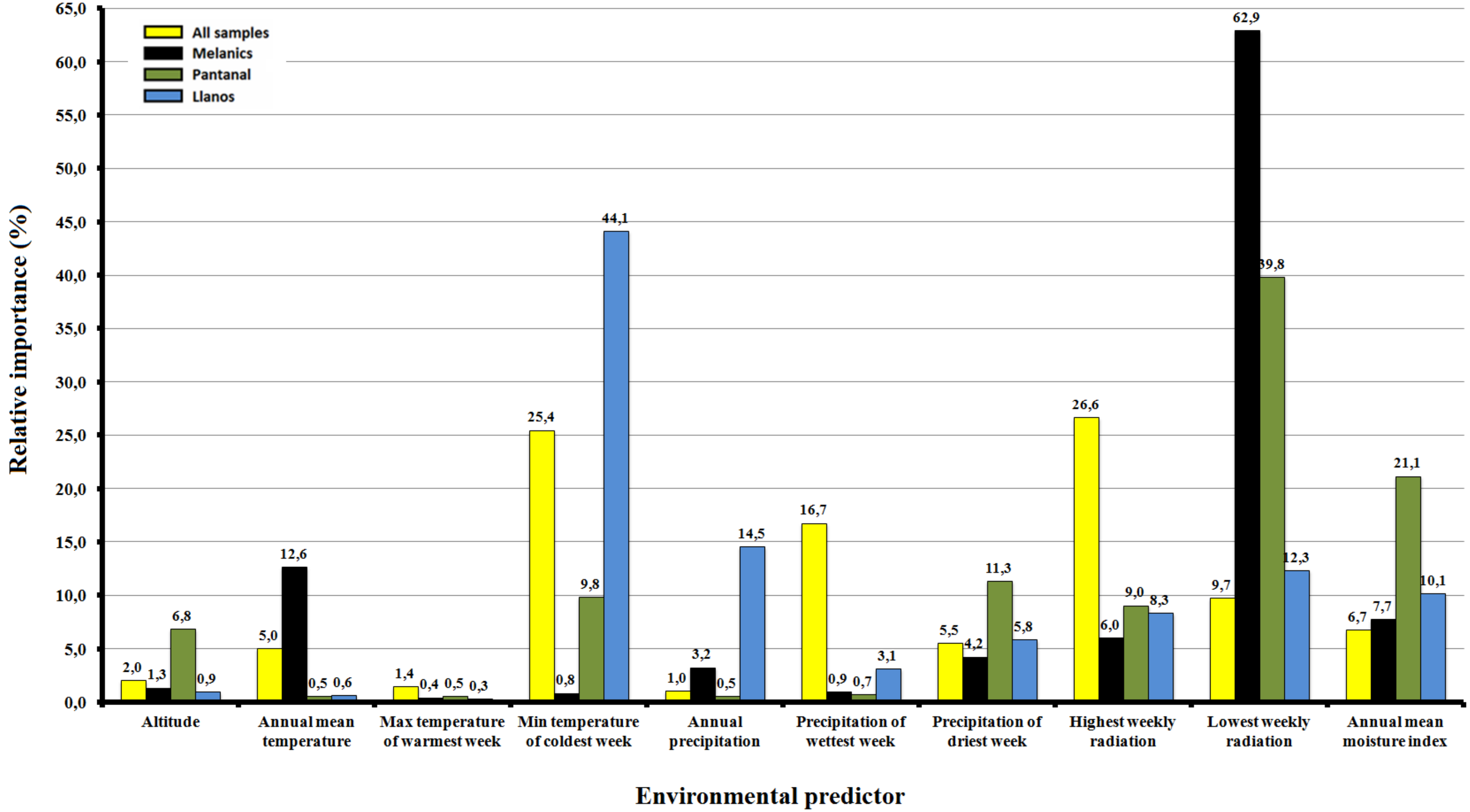

A
30°N
10°N
10°S
30°S
50°S
100°W
80°W
60°W
40°W
suitability
0%
100%
N
W
E
S
0 250 500 1,000 1,500
Kilometers
B
30°N
10°N
10°S
30°S
50°S
100°W
80°W
60°W
40°W
suitability
0%
100%
N
W
E
S
0 250 500 1,000 1,500
Kilometers

Figure 4



All samples
Melanics
Pantanal
Llanos
Relative importance (%)
65,0
60,0
55,0
50,0
45,0
40,0
35,0
30,0
25,0
20,0
15,0
10,0
5,0
0,0
2,0
1,3
6,8
0,9
5,0
12,6
0,5
0,6
1,4
0,4
0,5
0,3
25,4
0,8
9,8
44,1
1,0
3,2
0,5
14,5
16,7
0,9
0,7
3,1
5,5
4,2
11,3
5,8
26,6
6,0
9,0
8,3
9,7
62,9
39,8
12,3
6,7
7,7
21,1
10,1
Altitude
Annual mean temperature
Max temperature of warmest week
Min temperature of coldest week
Annual precipitation
Precipitation of wettest week
Precipitation of driest week
Highest weekly radiation
Lowest weekly radiation
Annual mean moisture index
Environmental predictor

CAPÍTULO 3:

ARTIGO CIENTÍFICO

"GEOGRAPHIC DISTRIBUTION AND MACROECOLOGICAL ASSESSMENT OF COLORATION PHENOTYPES IN A POLYMORPHIC NEOTROPICAL FELID, THE JAGUARUNDI (*Puma yagouaroundi*)"

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GEOGRAPHIC DISTRIBUTION AND MACROECOLOGICAL ASSESSMENT OF COLORATION PHENOTYPES IN A POLYMORPHIC NEOTROPICAL FELID, THE JAGUARUNDI (*Puma yagouaroundi*)

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Short title: "Geographic distribution of phenotypes in jaguarundis".

ABSTRACT

The jaguarundi (*Puma yagouaroundi*) is a small cat with a broad distribution across the Americas, which presents two main coloration phenotypes (dark brown/gray vs. red/reddish). Although these coat color variants have been known for decades, and historically speculated to be associated with different habitats, their exact geographic distribution has never been mapped across the species' range. Moreover, their association to different habitats has never been tested statistically, so that their ecological relevance with respect to varying environmental features remains unknown. Based on 463 location records encompassing the entire historical range of the species obtained from camera-traps, captures and skins held in scientific collections, we produced suitability models for both jaguarundi phenotypes based on niche modeling from environmental predictors, and compared them with a control model for the species as a whole. The frequency of dark jaguarundis is *ca.* 80%, while reddish animals represent *ca.* 20% of our overall sample set. However, there were marked differences in these frequencies across regions. Dark animals were significantly associated with moist and dense forests, while reddish forms were associated with dry areas such as deserts and xeric landscapes. Accordingly, there were clear differences in the geographic distribution models of these coat colors phenotypes. These results demonstrate that the spatial distribution of these coloration features is non-random, and suggest that some habitat characteristics likely influence the occurrence of these different forms. We assessed the suitability models to investigate whether particular environmental variables could explain these different distributions. Although there were detectable differences between the dark and reddish models (affecting variables such as moisture, temperature, precipitation and radiation), we did not identify a clear-cut pattern that could easily

demonstrate an effect of natural selection on traits such as camouflage or thermoregulation, suggesting that perhaps a more complex interplay of different ecological processes regulates this system over evolutionary time.

Keywords: melanism, polymorphism, natural selection, distribution models, phenotypes frequency.

INTRODUCTION

A great diversity of morphological phenotypes variation is observed in vertebrates. Unraveling the molecular basis and adaptive role of phenotypic variants has been a focus of attention in several areas of evolutionary biology. The ecology of some species can affect the frequency of its genetic variants (Mukherjee *et al*., 2010), and phenotypes in natural populations can present spatial patterns associated with particular environments (Eizirik & O'Brien 2003; Novembre & DiRienzo, 2009), possibly implying behavioral or ecological relevance (Lande, 1976; West-Eberhard, 1989; Majerus, 1998; Caro, 2005). Analyses integrating information on coloration patterns and environmental characteristics that influence ecological processes (such as camouflage and disruptive coloration, intra and interspecific communication and physiology) have the potential to illuminate the evolutionary processes involved in the generation and maintenance of polymorphic phenotypes in nature (Barsh, 1996; Nachman *et al*., 2003; Hoekstra, 2006).

Several biological factors such as thermoregulation, aposematism, camouflage, susceptibility or response to disease, sexual selection and reproductive success are classically associated with melanism (coat color darkening in relation to what would be considered the 'normal' or 'wild' phenotype) in different species (Majerus, 1998). Putative associations between darkened coats and some types of environment have been mentioned in early studies of animal coloration, and used to propose the classical hypothesis that melanistic animals are favored in wetter areas covered by dense vegetation (e.g. tropical forests) (Gloger, 1833; Poulton, 1890; Beddard, 1895; Cott, 1940; Ulmer, 1941). Additionally, previous studies have suggested that open areas might have a negative impact on dark individuals, due to the effects of high sunlight/radiation levels, as well as high mean temperatures in some areas (Ortolani & Caro, 1996; Majerus & Mundy, 2003).

The occurrence of melanism is common in the Felidae, having been so far documented in 13 of the 38 species, with strong evidence for at least eight independent origins in this family over evolutionary time (Schneider *et al.*, 2012). The biological effects and even the geographic distribution of felid melanistic variants are not clearly known at this time, but recent analyses indicate that melanism in some cases can reach very high frequencies in regional populations (e.g. Kawanishi *et al.*, 2010). Such observations, along with the multiple origins of melanism in the family and repeated increases in frequency in different populations, support the hypothesis that melanism can provide an adaptive advantage in certain ecological conditions (Caro, 2005; Eizirik & O'Brien 2003; Eizirik *et al.*, 2003; Allen *et al.*, 2010).

The jaguarundi (*Puma yagouaroundi*) is a small Neotropical cat whose ecology is still poorly known (Grassman & Tewes 2004; Maffei *et al.*, 2007). Its range extends from the southern United States to Argentina (Sunquist & Sunquist 2002; Almeida *et al.*, 2013; Caso *et al.*, 2013) and includes a wide variety of habitats, from semiarid and grassland areas to dense dry and wet forests (Oliveira, 1998; Sunquist & Sunquist 2002). The species is listed as 'least concern' by the IUCN (Caso *et al.*, 2013) and vulnerable in regional lists (Almeida *et al*., 2013). Habitat loss, fragmentation and human persecution are the most important threats to the species (Almeida *et al*., 2013; Caso *et al*., 2013). It is considered to be a diurnal cat (Oliveira, 1998; Maffei *et al*., 2007), with a generalist diet (Tófoli *et al*., 2009) and occurring at low densities (Oliveira *et al*., 2010). Its population size is poorly known globally or regionally, but there is some evidence indicating a trend for a demographic decline (Almeida *et al*., 2013).

The species is a unique felid in several respects, especially related with diurnal and arboreal behaviors. It is the only felid whose pelage in completely unmarked (i.e. devoid of stripes or spots) throughout its life. Moreover, there is marked coloration polymorphism in this species, with two main forms that can be easily recognized (Figure 1). The ancestral phenotype in jaguarundis is the reddish form, and melanism is caused by a semi-dominant mutation in the *MC1R* (*Melanocortin 1-Receptor*) gene that induces the formation of the dark brown/gray phenotype (Eizirik *et al*., 2003). Although these two main forms have been known for many years and anecdotally speculated to be associated with different habitats (e.g. Sunquist & Sunquist 2002, Grassman & Tewes, 2004, Grigione *et al*., 2007 and Maffei *et al*., 2007) their exact geographic distributions have never been mapped, and such associations have remained untested.

The goal of the present work was to conduct a survey of the habitat suitability of the main jaguarundi coloration phenotypes, and to test their association with different types of environments. We built a large-scale (range-wide) spatial distribution models for the two forms as well as for the species as a whole, and tested two alternative hypotheses: (1) melanism occurs randomly across all environments (absence of association between melanism and different landscapes); and (2) melanism presents a non-random distribution, and a significant association with particular biomes. Our results support the latter hypothesis, and open up new avenues for the investigation of the evolutionary ecology of coloration diversity in the elusive and poorly known felid.

METHODS

Database construction

The database included location records from the entire historical range of the jaguarundi, from Southern United States to Argentina, in various different biomes and ecoregions. These occurrence points were from four different sources: (1) Individuals in scientific collections that presented geographical coordinates and information about coat color (or preferably, photographic documentation); (2) Captures and individuals found dead in fieldworks, (3) Records from camera traps and (4) Reports by researchers in fieldwork or bibliographical sources already published. All records were converted into degree coordinates using the *WGS84* datum.

Because the species presents some color variants that cannot be easily categorized into reddish or dark (i.e. intermediate colors, or heterogeneous patterns across different body regions), doubtful animals were excluded from the dataset. We therefore did our analyses on a set of individuals whose colors could be confirmed and reliably classified into reddish or dark. We used the full dataset to generate a control model for the distribution of the species as a whole, against which we compared phenotype-specific models (see below). Since our sampling of records was opportunistic and unbiased with respect to coloration phenotypes (i.e. different phenotypes had the same capture probability), we assumed that the observed proportion of each color in the overall dataset corresponded to its actual species-wide frequency.

Such overall frequencies were then used to generate expected values for use in association tests performed for each biome/ecoregion.

Selection of environmental variables

We mapped the occurrence of different phenotypes throughout the species' distribution by inserting location records into an ArcGis 9.3 database (ESRI, 2010). We used shapefiles of biomes and terrestrial ecoregions (Olson *et al*., 2001; Hoekstra *et al*., 2010) as mask layers to extract and analyze information on the natural landscapes in which these phenotypes occur. Such mapping exercise allowed an initial assessment of potential relationships between jaguarundi coloration phenotypes and landscape conformations across the species' range.

To generate our distribution models, we initially considered 37 explanatory environmental variables and landscape data. We used 35 environmental variables obtained from the Worldclim (http://www.worldclim.org) and Climond (http://www.climond.org) databases, such as: annual mean temperature (Bio01), mean diurnal temperature range (Bio02), isothermality (Bio03), temperature seasonality (Bio04), max temperature of warmest week (Bio05), min temperature of coldest week (Bio06), temperature annual range (Bio07), mean temperature of wettest quarter (Bio08), mean temperature of driest quarter (Bio09), mean temperature of warmest quarter (Bio10), mean temperature of coldest quarter (Bio11), annual precipitation (Bio12), precipitation of wettest week (Bio13), precipitation of driest week (Bio14), precipitation seasonality (Bio15), precipitation of wettest quarter (Bio16), precipitation of driest quarter (Bio17), precipitation of warmest quarter (Bio18), precipitation of coldest quarter (Bio19), annual mean radiation (Bio20), highest weekly radiation

(Bio21), lowest weekly radiation (Bio22), radiation seasonality (Bio23), radiation of wettest quarter (Bio24), radiation of driest quarter (Bio25), radiation of warmest quarter (Bio26), radiation of coldest quarter (Bio27), annual mean moisture index (Bio28), highest weekly moisture index (Bio29), lowest weekly moisture index (Bio30), moisture index seasonality (Bio31), mean moisture index of wettest quarter (Bio32), mean moisture index of driest quarter (Bio33), mean moisture index of warmest quarter (Bio34), and mean moisture index of coldest quarter (Bio35). Altitudes for the location points were obtained from the SRTM database (http://www2.jpl.nasa.gov/srtm) and landscape information was obtained from the ESA GlobCover Project 2009 (http://due.esrin.esa.int/globcover). All variables were analyzed using a fine (~1 km) spatial resolution.

To avoid model overfitting induced by correlation among explanatory variables, we performed Pearson's correlation coefficient test (*r*) between each pair of variables (Kumar & Stohlgran (2009); Raes *et al*., 2009; Mukherjee *et al*., 2010) using the statistical software package SPSS 17.0. The correlation was assessed by extracting variable information from 10,000 unique and randomly generated points sampled from the known present geographic distribution layer of jaguarundis (obtained from IUCN and complemented by our records) using ArcGis 9.3. We selected 12 predictors that were not highly correlated with each other, using *r*=0.7 as the cut-off value, and employed them as ecological indicators for niche modeling (Wiens, 2011). The selected variables were: annual mean temperature, temperature seasonality, temperature annual range, annual precipitation, precipitation of driest week, precipitation of wettest quarter, precipitation of driest quarter, annual mean radiation, annual mean moisture index, highest weekly moisture index, lowest weekly moisture index and altitude.

Setting and running models

We modeled the spatial distribution of jaguarundis using the maximum entropy algorithm implemented in the software package Maxent (Philips *et al*., 2006), a robust statistical method for predictions of species distributions (Waltari *et al*., 2007; Philips & Dudik, 2008; Elith *et al*., 2010; Merow *et al*., 2013). We ran and assessed three different models: (1) total set of samples (control model); (2) subset comprising only dark animals (melanism model); (3) subset comprising only reddish animals. For each of these sample sets, we used 70% of the included points for training and 30% for testing the models. The data were resampled using the bootstrap routine of 10 random partitions with replacements (Pearson, 2007). All runs were configured in random seed, convergence threshold of 1E-5 with 500 iterations and 10,000 hidden background points (Ferraz *et al*., 2012). Model performance was assessed by the AUC (Area Under Curve) value for the Receiver Operating Characteristic (ROC) curve (Pearson, 2007; Tôrres *et al*., 2012; Calabrese *et al*., 2013).

RESULTS

We obtained 463 individuals: 94 reddish records and 369 dark records and found different phenotype frequencies among different landscape conformations (biomes and ecoregions, Table 1). Considering all samples from our database, 79.7% of the animals were dark and 20.3% were reddish. Maxent models were considered satisfactory (AUC $\geq$ 0.9): control model (AUC training = 0.961, test = 0.943; Figure 2A), dark or melanistic animals (AUC training = 0.963, test = 0.956, Figure 2B), and reddish animals (AUC training = 0.960, test = 0.954, Figure 2C). Moreover, our database updates the current IUCN distribution map of the species, filling geographic gaps where jaguarundis had not been recorded previously.

Dark jaguarundis occurred in all biomes in which the species was recorded, whereas reddish individuals were totally absent from flooded grasslands and savannas (Table 1). Additionally, the observed frequency of these phenotypes was quite different among biomes. Considering the proportion of distinct coat color patterns in our database as an overall standard for the species as a whole, we found no significant departures in tropical and temperate grasslands and savannas (76,5% dark, 23,5% red), nor in dry forests (79,1% dark, 20,9% red). However, in moist forests we found a significantly higher frequency of dark jaguarundis (87,3% dark, 12,7% red; $p<0.05$), while in desert and xeric areas there was a significantly higher proportion of the reddish form (32,7% dark, 67,3% red; $p<0.05$) (Table 2).

Our niche models provided additional corroboration to our inference of the geographic distribution of these different phenotypes (Figure 3). The control model was effective at predicting the overall jaguarundi distribution quite accurately, and the model assessed for the dark animals was quite similar. In contrast, there were marked differences in the model estimated for reddish animals, such as the low habitat suitability in most of the Amazon basin, in the Pantanal and portions of the Cerrado ecoregion, and the increased suitability in the Caatinga ecoregion in northeastern Brazil. When we assessed the relative importance of all predictor variables used to generate the different distribution models, we perceived some differences (Figure 4) that may be relevant to begin explaining the observed patterns. Is clear that the most influential predictor in the control model was temperature seasonality. For the melanistic model, annual temperature range and annual mean radiation had higher impact, whereas for the reddish model the highest and lowest weekly moisture index were the key predictors.

DISCUSSION

According to Pires (2012), there is no geographic/genetic structure in jaguarundi populations that might explain the pattern of coat color distribution described here. Although there were limitations in sampling across the Amazon forests, this previous study identified a single genetic unit south of the Amazon river, with a seemingly continuous distribution that includes northeastern Brazil and southern Brazil/Patagonia (which are areas where the reddish forms appear to be abundant). In addition, that study supported the inference that there was historical gene flow in the recent past between the major groups located south and north of the Amazon river. These results go against the hypothesis that population structure could have led to the observed pattern of phenotypes distribution. The most probable scenario is an emergence of the melanism allele at a particular location and its subsequent expansion throughout the jaguarundi distribution, driven by natural selection, while the ancestral alleles coding for the reddish phenotypes maintained some adaptive advantage in some regions.

For a character to be recognized as adaptive, it must be derived and involved in the response of a selective agent (Futuyma, 2009). It is therefore interesting to test whether a single-locus polymorphism displays an evolutionary dynamics that is contrary to equilibrium expectations (Kreitman, 2000). Random geographic distribution patterns across connected natural populations is the normal situation for a neutral phenotype, while nonrandom patterns may indicate the occurrence of natural selection affecting the trait. To assess the adaptive relevance of a stable polymorphism such as coat colors in wild cats, it is necessary to consider the phenotype frequency among different landscapes that are connected by historical gene flow. In jaguarundis, it is relevant to point out that the derived coat color (dark) is much more common and widely distributed than the ancestral form (red). Reddish jaguarundis are restricted to only four geographic regions (southern Brazil to Patagonia, northeastern Brazil, northern Peru to Colombia and Yucatan peninsula to southern United States), which is corroborated by the niche model, rejecting the null hypothesis that the distribution of phenotypes is random and unrelated to biogeographic constraints (hypothesis cited by Eizirik & O'Brien [2003] and Eizirik *et al*., [2003]). This pattern leads us to conclude that coat color in jaguarundis is affected by natural selection related to environmental features that vary among biomes.

Ecological niche models can combine statistical techniques with geographic information systems in predictive ecology and especially in macroecological analysis (Elith *et al*., 2010; Calabrese *et al*., 2013). The models shown in Figure 2 A-C were designed to provide an analysis of the relative influence of all predictor variables, to explain the geographic distribution of distinct phenotypes. The main differences between the generated models were related with annual mean temperature, annual mean radiation and moisture index (Figure 4). All of these predictors exert different influences on distinct landscape conformations, and it is difficult to draw precise interpretations from this pattern alone. Although the influence of these variables may be direct (e.g. solar radiation being related to thermoregulation aspects), it is also plausible to conclude that they may affect landscape features that are themselves the selective agents on jaguarundis (e.g. related to camouflage efficacy). Reddish jaguarundis are clearly more common in open habitats (and adjacent forested areas), while the frequency of dark animals is higher in close forests. This type of association is reminiscent of the hypotheses put forth in the last two centuries by Gloger (1833), Poulton (1890) and Cott (1940). The models generated in our study were found to be robust compared with our initial data set and the presently known distribution of the species. However, it is important to highlight that the niche models are based on predictors and their relative importance to generate distribution maps. It is therefore important to be cautious and not discard the possibility that some relevant predictor may have been lost in the pre-selection of variables based on the correlation test, or that additional variables that are perhaps more important were not even included in the initial set employed in our analysis. Additional assessments will be required to test these possibilities.

Location records from our database and our niche models corroborate previous hypotheses postulating that melanism in jaguarundis is associated with landscape conformations and therefore reject the null hypothesis that the distribution is random across all biomes. Our analyses suggest that the association with different biomes is related to the effect of environmental variables such as temperature, radiation and moisture. Although the species is present in more than 60 ecoregions, reddish forms were recorded in less than half of these areas. Moreover, our results clarified the previously undocumented spatial distribution of coat color variants in this species, opening up the possibility of investigating their adaptive significance. Further studies about melanism are necessary to better understand this coat color variant in natural populations of jaguarundis, especially testing and ranking thermoregulation along with camouflage effectiveness. This species remains poorly known, and appears to be common due to frequent sightings and the speculation that it can be tolerant to semi-altered and fragmented areas (Almeida *et al*., 2013). However, additional studies are necessary to understand more completely its ecology, demography, genetics and conservation status. We hope that this study will serve to foster increased interest in this remarkable species, and also stimulate research focusing on other polymorphic phenotypes, contributing to better understand their adaptive relevance in different ecological contexts.

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SUPPLEMENTARY MATERIAL

Supplementary table 1 - Location records for *Puma yagouaroundi* (pdf).

***Apêndice 2**

TABLE LEGENDS

Table 1 – Distribution of records of dark and reddish jaguarundis in different biomes and ecoregions. Ecoregions listed in red font indicate the presence of reddish individuals.

Table 2 – Association test of landscape variables (biomes) with groups of samples (red/dark). Adjusted residuals <-2 or >2 indicate significant departure from the null hypothesis of no association, for alpha=0.05.

FIGURE LEGENDS

Figure 1 – Main coat colors of *P. yagouaroundi*: (A) Reddish; and (B) Dark brown/gray (melanistic). Photos: T.G. de Oliveira.

Figure 2 – Maps depicting the location of jaguarundi records used in this study, overlaid onto the distribution of Neotropical biomes. (A) Dark individuals; (B) Red/reddish individuals.

Figure 3 – Potential distribution map for jaguarundis: (A) Distribution of the species as whole (control model; n=463); (B) Distribution of dark animals (n=369) and (C) Distribution of reddish animals (n=94).

Figure 4 – Relative importance (%) of each predictor variable used in the models: species-wide (control model): yellow; dark-only: gray; reddish-only: red.

TABLE 1

Biome	Ecoregion	Samples (D = Dark / R = Red)	Total Biome
Deserts and Xeric Shrublands	Caatinga	38 (8D / 30R)	49 (16D / 33R)
	Chihuahuan desert	1 (1R)	
	Chihuahuan-Tehuacán Deserts	1 (1D)	
	Guajira-Barranquilla xeric scrub	4 (4D)	
	La Costa xeric shrublands	1 (1D)	
	Paraguana xeric scrub	1 (1D)	
	Tamaulipan matorral	1 (1R)	
	Tamaulipan mezquital	2 (1D / 1R)	
Flooded Grasslands and Savannas	Pantanal	9 (9D)	9 (9D)
Temperate Grasslands, Savannas and Shrublands	Dry Chaco	2 (2D)	7 (5D / 2R)
	Espinal	1 (1R)	
	Humid Pampas	1 (1R)	
	Low Monte	3 (3D)	
Tropical and Subtropical Dry Broadleaf Forests	Apure-Villavicencio dry forests	6 (3D / 3R)	43 (34D / 9R)
	Atlantic Dry Forests	12 (11D / 1R)	
	Central American dry forests	3 (3D)	
	Chiapas Depression dry forests	1 (1R)	
	Chiquitano Dry Forests	1 (1D)	
	Ecuadorian dry forests	1 (1D)	
	Magdalena Valley dry forests	1 (1D)	
	Mesoamerican Pine-Oak Forests	4 (4D)	
	Sinaloan dry forests	1 (1R)	
	Southern Mexican Dry Forests	10 (10D)	
	Southern Pacific dry forests	2 (2R)	
	Yucatán dry forests	1 (1R)	
Tropical and Subtropical Grasslands, Savannas and Shrublands	Beni savanna	2 (2D)	87 (71D / 16R)
	Cerrado	37 (33D / 4R)	
	Dry Chaco	12 (7D / 5R)	
	Guianan savanna	1 (1D)	
	Humid Chaco	2 (2D)	
	Llanos	1 (1D)	
	Uruguayan savanna	22 (17D / 5R)	
	Western Gulf coastal grasslands	10 (8D / 2R)	
Tropical and Subtropical Moist Broadleaf Forests	Alto Paraná Atlantic forests	84 (72D / 12R)	268 (234D / 34R)
	Amazon River and Flooded Forests	7 (7D)	
	Atlantic Forests	16 (11D / 5R)	
	Araucaria moist forests	33 (26D / 7R)	
	Central American Atlantic moist forests	1 (1D)	
	Central Andean Yungas	11 (11D)	
	Chocó-Darién Moist Forests	4 (4D)	
	Costa Rican seasonal moist forests	1 (1D)	
	Guianan Moist Forests	12 (12D)	
	Isthmian-Atlantic moist forests	2 (2D)	
	Isthmian-Pacific moist forests	2 (2D)	
	Madeira-Tapajós moist forests	1 (1D)	
	Magdalena-Urabá moist forests	2 (2D)	
	Maranhão Babaçu forests	1 (1D)	
	Mato Grosso seasonal forests	9 (7D / 2R)	
	Petén-Veracruz moist forests	8 (6D / 2R)	
	Napo Moist Forests	9 (8D / 1R)	
	Northeastern Brazil restingas	1 (1R)	
	Northern Andean Montane Forests	9 (9D)	
	Serra do Mar coastal forests	21 (21D)	
	Southwest Amazon moist forests	3 (3D)	
	Southwestern Amazonian Moist Forests	4 (4D)	
	Tapajós-Xingu moist forests	3 (3D)	
	Tocantins/Pindare moist forests	6 (3D / 3R)	
	Uatuma-Trombetas moist forests	3 (3D)	
	Veracruz moist forests	13 (12D / 1R)	
	Xingu-Tocantins-Araguaia moist forests	1 (1D)	
	Yucatán moist forests	1 (1D)	

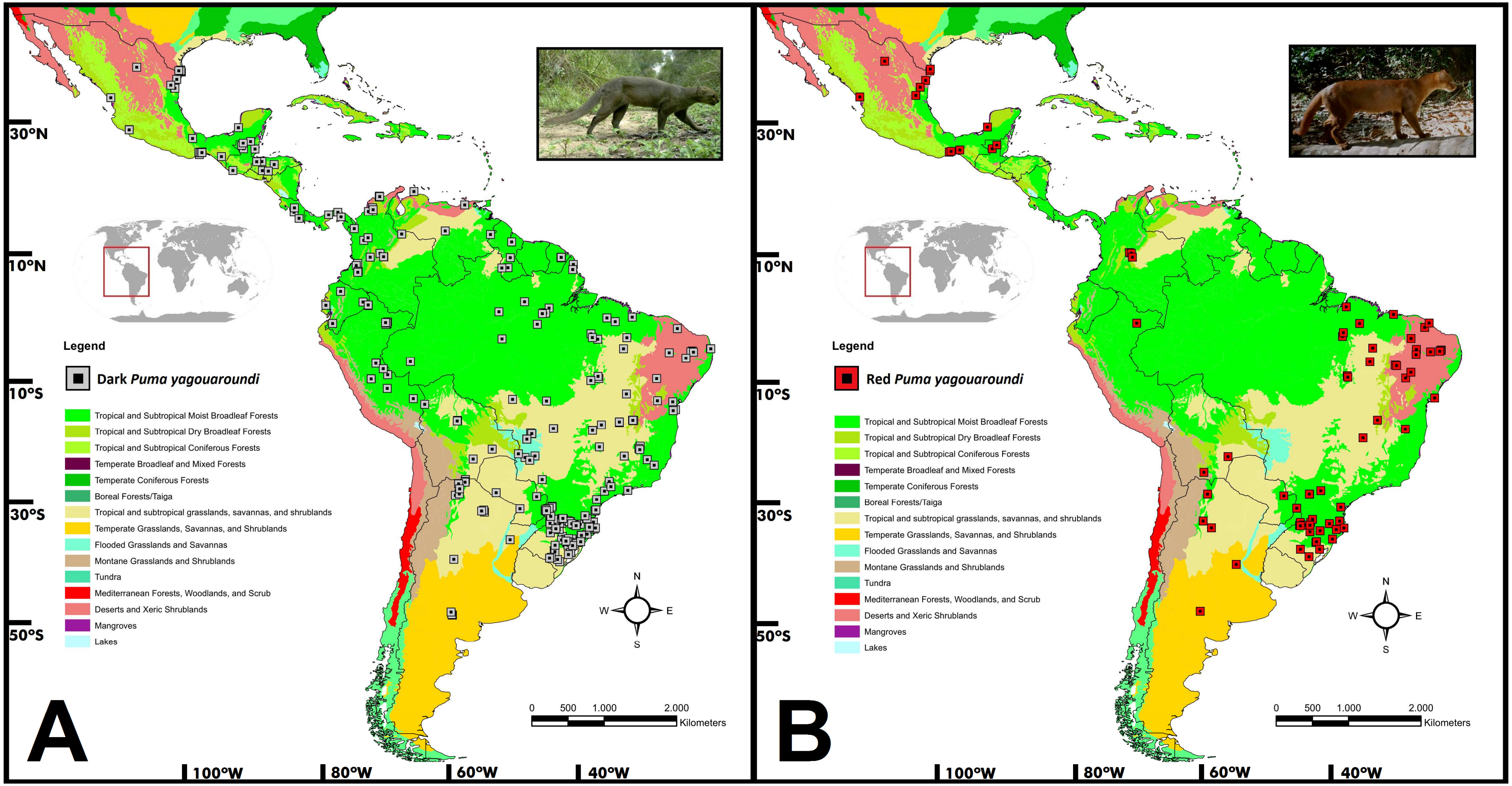
TABLE 2

Biome	Statistics	Groups		Total
		Dark	Red	
Desert and Xeric Shrublands	Count	16	33	49
	Expected	39,1	9,9	49,0
	% within landscape	32,7%	67,3%	100,0%
	% within groups	4,3%	35,1%	10,6%
	% of Total	3,5%	7,1%	10,6%
	Adjusted Residual	-8,7	8,7	
Flooded Grasslands and Savannas	Count	9	0	9
	Expected	7,2	1,8	9,0
	% within landscape	100,0%	,0%	100,0%
	% within groups	2,4%	,0%	1,9%
	% of Total	1,9%	,0%	1,9%
	Adjusted Residual	-1,5	1,5	
Temperate Grasslands, Savannas and Shrublands	Count	5	2	7
	Expected	5,6	1,4	7,0
	% within landscape	71,4%	28,6%	100,0%
	% within groups	1,4%	2,1%	1,5%
	% of Total	1,1%	,4%	1,5%
	Adjusted Residual	-,5	,5	
Tropical and Subtropical Dry Broadleaf Forest	Count	34	9	43
	Expected	34,3	8,7	43,0
	% within landscape	79,1%	20,9%	100,0%
	% within groups	9,2%	9,6%	9,3%
	% of Total	7,3%	1,9%	9,3%
	Adjusted Residual	-,1	,1	
Tropical and Subtropical Grasslands, Savannas and Shrublands	Count	71	16	87
	Expected	69,3	17,7	87,0
	% within landscape	81,6%	18,4%	100,0%
	% within groups	19,2%	17,0%	18,8%
	% of Total	15,3%	3,5%	18,8%
	Adjusted Residual	,5	-,5	
Tropical and Subtropical Moist Broadleaf Forest	Count	234	34	268
	Expected	213,6	54,4	268,0
	% within landscape	87,3%	12,7%	100,0%
	% within groups	63,4%	36,2%	57,9%
	% of Total	50,5%	7,3%	57,9%
	Adjusted Residual	4,8	-4,8	
Total	Count	369	94	463
	% of Total	79,7%	20,3%	100,0%

Chi-square = 79.425 ; with 463 valid cases.

FIGURE 1

FIGURE 2



A
Legend
Dark Puma yagouaroundi
Tropical and Subtropical Moist Broadleaf Forests
Tropical and Subtropical Dry Broadleaf Forests
Tropical and Subtropical Coniferous Forests
Temperate Broadleaf and Mixed Forests
Temperate Coniferous Forests
Boreal Forests/Taiga
Tropical and subtropical grasslands, savannas, and shrublands
Temperate Grasslands, Savannas, and Shrublands
Flooded Grasslands and Savannas
Montane Grasslands and Shrublands
Tundra
Mediterranean Forests, Woodlands, and Scrub
Deserts and Xeric Shrublands
Mangroves
Lakes
30°N
10°N
10°S
30°S
50°S
100°W
80°W
60°W
40°W
0 500 1.000 2.000 Kilometers
N S E W
B
Legend
Red Puma yagouaroundi

FIGURE 3

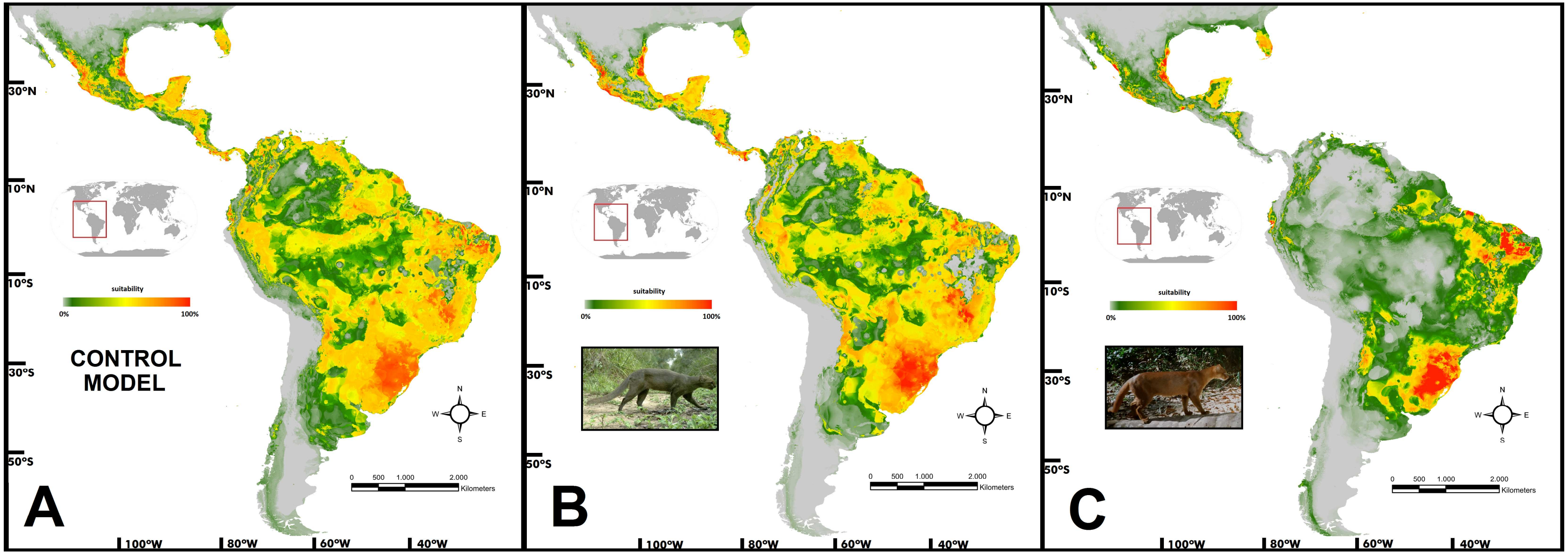
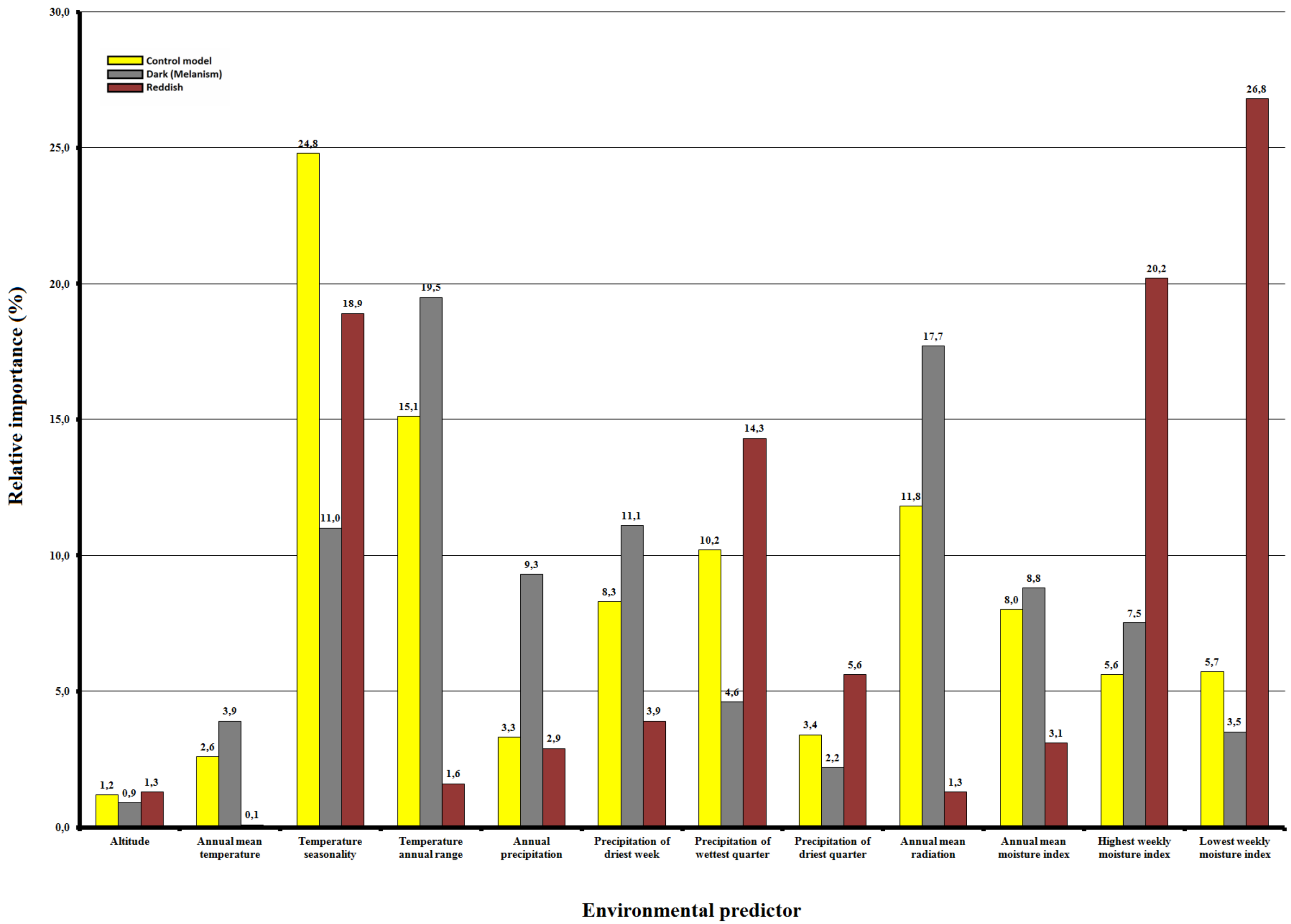
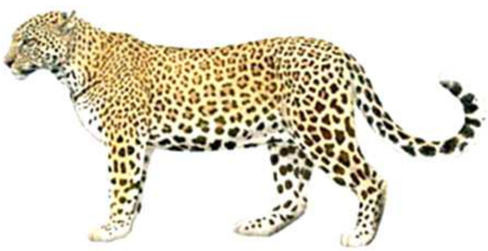

30°N
10°N
10°S
30°S
50°S
100°W
80°W
60°W
40°W
suitability
0%
100%
CONTROL MODEL
N
W
E
S
0 500 1.000 2.000
Kilometers
A
B
C

FIGURE 4



Control model
Dark (Melanism)
Reddish
Relative importance (%)
30,0
25,0
20,0
15,0
10,0
5,0
0,0
1,2
0,9
1,3
2,6
3,9
0,1
24,8
11,0
18,9
15,1
19,5
1,6
3,3
9,3
2,9
8,3
11,1
3,9
10,2
4,6
14,3
3,4
2,2
5,6
11,8
17,7
1,3
8,0
8,8
3,1
5,6
7,5
20,2
5,7
3,5
26,8
Altitude
Annual mean temperature
Temperature seasonality
Temperature annual range
Annual precipitation
Precipitation of driest week
Precipitation of wettest quarter
Precipitation of driest quarter
Annual mean radiation
Annual mean moisture index
Highest weekly moisture index
Lowest weekly moisture index
Environmental predictor

CAPÍTULO 4:



ARTIGO CIENTÍFICO

"MAPPING BLACK PANTHERS: MACROECOLOGICAL MODELING OF MELANISM IN LEOPARDS (*Panthera pardus*)"

A ser submetido para a revista 'Proceedings of the Royal Society: Biological Sciences'

MAPPING BLACK PANTHERS: MACROECOLOGICAL MODELING OF MELANISM IN LEOPARDS (*Panthera pardus*)

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ABSTRACT

The precise geographic distribution and habitat association of most mammalian polymorphic phenotypes are still poorly known, which hampers an in-depth assessment of their adaptive relevance. Even in the case of black panthers, an iconic melanistic variant of the leopard (*Panthera pardus*) known for centuries and popularly speculated to be adaptive in forested habitats, no map exists describing its exact geographic distribution and its occurrence in different landscape conformations. In this study, we used a large database of location records from camera-traps, captures and museum specimens sampled across the species' range to produce a new potential distribution map for leopards, as well as to describe the occurrence of melanism in this felid. We estimated distributions for melanistic and non-melanistic leopards based on niche modeling and environmental predictors. The frequency of melanism in leopards is *ca.* 10%, with most of the melanistic records originating from moist forests. This result suggested a relationship between habitat type and the presence of melanistic leopards, which was supported by the suitability model. Our data demonstrate that melanism is not randomly distributed in leopards (which would be expected for interconnected populations if this was a neutral polymorphism), but rather that different landscapes have significantly different frequencies of dark animals. The habitat suitability models allowed us to assess the effect of different environmental variables on the distribution of leopards in general, as well as on melanistic individuals. Using the global model (all leopards) as a control, we observed differences in the melanism model with respect to the relative effects of moisture, temperature, precipitation and radiation, suggesting that these variables might play a role in the dynamics of this polymorphism in natural habitats. Overall, our results indicate that melanism in leopards is affected by natural selection, possibly related to efficacy of thermoregulation and/or camouflage in different landscape conformations. These findings therefore support classical hypotheses on adaptive coloration in animals (e.g. Gloger's rule), and open up new avenues for in-depth ecological and evolutionary analyses of melanism in felids.

Keywords: polymorphism, landscape, moist forests, natural selection, distribution models.

INTRODUCTION

Ecologically relevant features such as morphology, camouflage and disruptive coloration, intra- and interspecific communication, as well as physiology, are controlled by evolutionary processes such as genetic drift and natural selection. Among such features, animal coloration has often been proposed to possess adaptive relevance, performing various roles in behavioral and ecological processes [1-3]. Interestingly, although considerable color variation is observed in vertebrates, its adaptive significance and molecular basis remain largely unknown.

In this context, it is relevant to note that the ecology of some species can drive genetic diversity [4], and phenotypes in natural populations can present spatial patterns of variation associated with adaptation to some environments, regulated by natural selection [5-6]. By connecting coloration diversity to environmental informations which may have a direct or indirect influence on the adaptive significance of coat color variants [7], it is possible to investigate evolutionary processes involved in the generation and maintenance of phenotypes in nature [8]. Despite the interest in the subject, relatively few studies have addressed the association between different environments and the distribution of phenotypes [7-8].

Melanism is characterized by a darkening of the external coloration in relation to what would be considered the ‘normal’ or ‘wild-type’ pigmentation. Several biological factors such as thermoregulation, camouflage, aposematism, susceptibility or response to disease, sexual selection and reproductive success have been classically associated with melanism in various groups of organisms [2]. There are classical hypotheses that postulate an adaptive role for melanism in different species (e.g. [3 and 9-10]). However, these classical ideas have rarely been rigorously tested [2]. References dating back to the 19th century cite the hypothesis of an association between melanistic individuals and wetter areas with dense vegetation (e.g. tropical forests) [9-13]. In addition, previous studies have also mentioned the possibility that selection against dark individuals might operate in open areas where solar radiation and mean temperatures are high [2, 10, 14].

The leopard is the largest spotted cat in Africa and Asia [15] and an important extant representative of genus *Panthera* [16-17]. Its historical distribution is the broadest among all felids (from the Russian far east to Africa), encompassing a diverse array of habitats, from deserts to rainforests, and from the humid tropics to temperate zones [15]. The species is listed as near-threatened by the IUCN, due to habitat loss, fragmentation and human persecution, with unknown population status in some areas. In addition, some remaining populations may be critically endangered, isolated and with small population sizes [18].

The occurrence of melanism is common in the Felidae, having been documented in 13 of the 38 species of the group, and having arisen independently at least eight times in the family [19-20]. Although variant pigmentation phenotypes in vertebrates are caused by several genes [21-22], in the case of leopards (*Panthera pardus*) (Figure 1) it has been shown that melanism is induced by a recessively inherited mutation in the *ASIP* (*Agouti Signaling Protein*) gene, which leads to a nonsense mutation predicted completely ablate *ASIP* function and thus induce black pigmentation [20].

Recent analyses have indicated that melanism can reach very high frequencies in some leopard populations (e.g. southeast Asia reported by [23]). In addition, there have been confirmed reports of melanistic leopards in India [15, 24-25], Abyssinia [26] and Ethiopian Highlands [15], Java and Malaysia [27-29], Aberdare Mount Kenya [15], Highlands of Nepal [30], as well as a doubtful occurrence in South Africa (cited in [15] and by [31]). These observations are restricted to some areas, and may support the hypothesis that melanism can provide an adaptive advantage in certain ecological conditions in wild cats [3, 5, 19, 32]. At least four of the nine currently recognized leopard subspecies (based on [33]) are already cited in the literature as having confirmed records of melanistic animals: *P. p. pardus*, *P. p. fusca*, *P. p. delacouri* and *P. p. melas*. However, the exact geographic range of this coloration phenotype has never been mapped in leopards in general, or in any of its subspecies.

We therefore set out to investigate the distribution of melanism in leopards, and conduct a systematic test of its association with different landscape conformations. In addition, we aimed to generate and assess spatial distribution models constructed for the species as a whole, as well as melanistic individuals in particular. Although some distribution models have been generated for leopards on a small geographic scale [34-36], no study had yet produced a model for its entire range. We therefore generated such a large-scale model, and used it as a control to investigate the geographic distribution and underlying ecological associations of melanism in this felid. We considered two alternative hypotheses: (1) melanism is present throughout the species distribution, occurring randomly in all environments (i.e. lack of association between melanism and different landscape conformations); and (2) melanism is distributed non-randomly, and its presence is associated with particular habitats and environmental parameters.

METHODS

Species data

We generated a database of location records spanning the entire historical range of the leopard, from the Russian far east to Africa, and representing a very broad suite of biomes and ecoregions (montane, mediterranean, temperate, mixed, moist and dry forests, grasslands, savannas, tundra, woodlands, shrublands and deserts). These records were obtained from four different sources: (1) specimens held in scientific collections that possessed precise information on their geographic origin, as well as coat color data (preferably individuals whose color could be directly ascertained and photographed); (2) individuals found dead or captured during field studies; (3) camera-trap data; and (4) reports by researchers doing fieldwork or published bibliographical sources.

Location records of individuals confirmed to be melanistic or non-melanistic were used in the statistical analyses based on the frequency of these phenotypes. In the global model of species distribution, we also included four points in which the presence of melanism was reported by not fully confirmed (referred to here as doubtful records). As there was no type of bias in our records with respect to coloration phenotype (i.e. sampling was random with regard to coat color), we assumed that the frequency in which melanism appears in the total data set represents the overall frequency in the species, which provided a null hypothesis against which we tested potential deviations in different regions.

Environmental predictors

The occurrence of different phenotypes throughout the leopard range was mapped by inserting location records of non-melanistic, melanistic and unconfirmed melanistic individuals into an ArcGis 9.3 [37] database. All the samples were converted into degree coordinates incorporating the *WGS84* system reference. Additionally, we used biome and terrestrial ecoregion shapefiles [38] as mask layers to extract and analyze information about natural landscapes in which the phenotypes are located.

To generate the potential distribution models (global and melanism-only), we initially employed 37 explanatory environmental variables and landscape data. We used 35 environmental variables obtained from the Worldclim (http://www.worldclim.org) and Climond (http://www.climond.org) databases: annual mean temperature (Bio01), mean diurnal temperature range (Bio02), isothermality (Bio03), temperature seasonality (Bio04), max temperature of warmest week (Bio05), min temperature of coldest week (Bio06), temperature annual range (Bio07), mean temperature of wettest quarter (Bio08), mean temperature of driest quarter (Bio09), mean temperature of warmest quarter (Bio10), mean temperature of coldest quarter (Bio11), annual precipitation (Bio12), precipitation of wettest week (Bio13), precipitation of driest week (Bio14), precipitation seasonality (Bio15), precipitation of wettest quarter (Bio16), precipitation of driest quarter (Bio17), precipitation of warmest quarter (Bio18), precipitation of coldest quarter (Bio19), annual mean radiation (Bio20), highest weekly radiation (Bio21), lowest weekly radiation (Bio22), radiation seasonality (Bio23), radiation of wettest quarter (Bio24), radiation of driest quarter (Bio25), radiation of warmest quarter (Bio26), radiation of coldest quarter (Bio27), annual mean moisture index (Bio28), highest weekly moisture index (Bio29), lowest weekly moisture index (Bio30), moisture index seasonality (Bio31), mean moisture index of wettest quarter (Bio32), mean moisture index of driest quarter (Bio33), mean moisture index of warmest quarter (Bio34) and, mean moisture index of coldest quarter (Bio35). We also incorporated data on altitude (obtained from the SRTM (http://www2.jpl.nasa.gov/srtm)) and landscape features (obtained from the ESA GlobCover Project 2009 (http://due.esrin.esa.int/globcover)). All variables were used at a fine (~1 km) spatial resolution.

To avoid problems of model overfitting caused by correlation among explanatory variables, we ran Pearson's correlation coefficient test (*r*) for each pair of variables [4, 39-40], using the SPSS 17.0 statistical software. We assessed this correlation by extracting variable information from 10,000 unique and randomly generated points inserted in the currently known geographic distribution layer of leopards (obtained from IUCN and complemented by our own records) using ArcGis 9.3. We selected 12 predictors that were not highly correlated with each other, using *r*=0.7 as the cut-off value. These variables were: annual mean temperature, maximum temperature of the warmest week, minimum temperature of the coldest week, annual precipitation, precipitation of the wettest week, precipitation seasonality, annual mean radiation, radiation seasonality, highest weekly moisture index, mean moisture index of the wettest quarter, mean moisture index of the driest quarter, and altitude. The landscape layer was excluded because it contained information on the present land cover, instead of historical data. We used these 12 selected predictors assuming that they were adequate and sufficient ecological indicators for niche and biogeographic modeling [41].

Modeling procedures

We modelled the overall distribution of leopards and the spatial distribution of melanism using the maximum entropy algorithm implemented in the Maxent software [42-46]. Three different models were generated and analyzed: (1) total set of samples (control model), (2) only the melanistic animals (melanism model), (3) only the samples from Southeast Asia (a region previously reported to harbor high melanism frequency by [23]). We used these different sample sets of location records, with 70% of points for training and 30% for testing the models. The data were sampled using the bootstrap routine of 10 random partitions with replacement [47]. All runs were configured in random seed, convergence threshold of 1E-5 with 500 iterations and 10,000 hidden background points [48], converting the results into binary models for all analyses. The model performance was assessed by the AUC (Area Under Curve) value for the Receiver Operating Characteristic (ROC) curve and the binomial probability [47, 49-50], to obtain distribution maps and a description of environmental parameters which most influence the spatial distribution of melanism in leopards.

RESULTS

We obtained 623 samples, comprising 552 non-melanistic individuals, 67 confirmed melanistic individuals, and four unconfirmed melanistic individuals (reports with no associated photographs). A map depicting the sample database is shown in figure 2 and described in the supplementary table. Our database provided a broad coverage of the known leopard distribution, as well as an update of the species' current range, by filling in geographic gaps in which leopards had not been officially recorded previously but were expected to occur (IUCN 2013 data).

Melanism presented a global frequency of 10.8% across the species' range, with regional frequencies varying among different landscape conformations (biomes and ecoregions; Table 1). The confirmed presence of melanistic leopards was recorded only in five of the nine currently valid subspecies (Figure 3): Africa (*P. p. pardus*), Central India, Nepal and Bhutan (*P. P. fusca*), Sri Lanka (*P. p. kotiya*), Southeast Asia (*P. p. delacouri*) and Java (*P. p. melas*). All of these regions contained new records for areas in which melanism had been previously described, as well as representation of additional areas. Melanism was absent in the leopard subspecies occurring in the Russian Far East (*P. p. orientalis*), Central China (*P. p. japonensis*), Arabian Peninsula (*P. p. nimr*) and Middle East (*P. p. saxicolor*). Additionally, we obtained three doubtful melanism records from Africa and one from Iran. These four points were removed from the melanism model, conservatively assuming the absence of melanism in these areas. It is noteworthy that three of these four records were located in areas in which the niche model (see below) indicated low probability of melanism occurrence, whereas the fourth record (located in the Ethiopian Highlands) did match an area with high probability of melanism occurrence.

Although leopards were found in more than 100 ecoregions, melanism was most common in tropical and subtropical moist forests (59 of 67 records, or 88%), especially in the Indian Ghats (India, n=8), Javan forests (Indonesia, n=7), Kayah-Karen/Tenasserim forests (Southeast Asia, n=16) and Peninsular Malaysian rain forests Southeast Asia, n=19). All of these records were consistent with high suitability of occurrence in our Maxent model for melanistic leopards (Figure 4). Differences among biomes were significant, especially in tropical and subtropical moist broadleaf forests, where 30% of the animals were black, which is almost three times more than expected if melanism were an evenly distributed neutral polymorphism (Table 2). In contrast, the frequency of melanism was significantly lower than expected in deserts/xeric shrublands, temperate broadleaf and mixed forests, as well as tropical/subtropical grasslands, savannas and shrublands (see Table 2).

Maxent niche models were considered satisfactory (AUC $\geq$ 0.9): control model (AUC training = 0.926, test = 0.924), melanism (AUC training = 0.976, test = 0.963), and Southeast Asia (AUC training = 0.993, test = 0.992). Control and melanism predicted distributions generated through niche models are presented in Figure 3A-B. This assessment allowed a comparison between the overall range of leopards and the presence of melanistic animals, showing regional enrichment for this variant in some areas, as well as its absence in many others. When we analyzed the environmental variables that were most influential on the three models (Figure 5), we observed that predictors related to precipitation and radiation tended to have the largest effects. We also observed differential effects of some predictors, such as the precipitation of the wettest week being much more influential on the melanism model than on the other two.

DISCUSSION

The database built for this study provided improvements on the knowledge about the current geographic distribution of leopards, especially in areas that were previously dubious regarding its presence (Figure 3). We used this improved map of the species' geographic range to analyze the distribution pattern of black panthers.

Our data revealed that the distribution of melanistic leopards is non-random across the species' range. Moist forests (especially in Southeast Asia) presented very high frequencies of melanistic leopards (e.g. 39 of 71 individuals [55%] in Southeast Asia), and more than 80% of the black animals in our database, a five-fold increase relative to the expected number based on the overall average. Furthermore, we found no confirmed melanistic leopards in the Middle East, Arabian Peninsula, Central China and Russian Far East (Figure 2), nor any mention in the literature as to the presence of melanism in these regions, indicating that this variant is really absent from these areas. Overall, there was a significant reduction in the frequency of melanism in some biomes that consist of open habitats or temperate forests (see Table 2). There thus is a clear pattern in which melanism tends to increase in tropical/subtropical moist forests, and decrease in open/dry or temperate habitats. Such a result supports the classical hypothesis postulating an adaptive role for melanism [5, 10-13 and 19], which would be favored in tropical and humid environments.

An alternative explanation is that variation in the melanism frequency could have been driven by demographic processes, including population structure and drift-induced differentiation. According to [33], some significant geographic structure can be identified in leopards, indicating the existence of restricted historical gene flow among some portions of the range. This division formed the basis for currently recognized leopard subspecies, although in that study the authors noted that in some areas, such as African continent, Arabian Peninsula, Sri Lanka and Java, the sampling was too sparse to identify clear-cut phylogeographic relationships. Nevertheless, the presence of demographic distinctiveness among at least the nine recognized species argues that such differentiation must be taken into account when comparing the frequency of melanism among regions. Although the possibility that demography has influenced the present-day frequency of melanism in leopards cannot be completely excluded, it is unlikely that it could explain most of the observed patterns, since each of the subspecies' ranges tends to contain a variety of landscape conformations. Therefore, demographic effects caused by historical differentiation among subspecies would tend to obscure, rather than generate, the observed pattern of association between melanism and forested habitats.

Therefore, we consider that the most probable historical scenario for melanism in leopards is the emergence of the causative allele at a particular location and its dispersal throughout much of the species' distribution, suffering selection under the influence of varying environmental conditions in different landscapes, as well as genetic drift in some situations (e.g. founding of new populations during range expansion events). Since melanism in leopards is a recessive trait [19], it is plausible that its causative allele can disperse long distances over evolutionary time even across habitats where it could be selected against (e.g. deserts and grasslands). This is because the allele can remain "hidden" in heterozygosity for many generations when it is at low frequency, while at the same it could be lost in some areas due to an effect of genetic drift [51]. Another possibility is that melanism arose in leopards more than once, e.g. hypothesizing a distinct mutation emerging in Africa, since the known *ASIP* mutation was reported only based on Asian samples [20]. Such a hypothesis can be directly tested with molecular approaches targeting the implicated region of the *ASIP* gene.

When the distribution of melanism in leopards is examined more closely, Southeast Asia emerges as a particularly interesting region. Our data support the findings reported by [23], showing that melanism is almost fixed in areas south of the Isthmus of Kra (Thailand/Malaysia). We obtained only two records of non-melanistic animals south of the Isthmus, while in more northerly areas both phenotypes appear at similar frequencies. This intriguing pattern may have been caused by some degree of demographic isolation across the Isthmus, which is consistent with the hypothesis that in the past (during the Last Glacial Maximum period, between 20000-25000 years ago, [52]) it operated as an effective ecological barrier restricting gene flow for several organisms. Differentiated evolutionary groups on both sides of the Isthmus have been found in different groups of organisms, such as plants [53], beetles [54], crustaceans [55] and even tigers [56]. The fact that present-day landscapes appear to be similar on both sides of the Isthmus argue for a demographic, rather than selective explanation of the high frequency of melanism in the southern portion. However, our analyses of environmental predictors that influence the distribution of leopards in Southeast Asia alone revealed some patterns that were distinct from the melanism model (see Figure 5). Although there were some concordant patterns between the melanism and Southeast Asian models (e.g. large influence of solar radiation parameters), there were also differences, indicating that additional analyses focusing specifically in this region may help clarify the underlying causes of the observed pattern.

Ecological niche models can combine statistical techniques with geographic information systems data in predictive ecology and especially in macroecological analysis [45, 50, 57-59] and can be an important tool to assess the geographic distribution of wild felids because they provide estimates of presence/absence [48-49]. The model shown in Figure 4 was designed to provide an analysis of the relative influence of all predictors, as well as to explain the differences in the geographic distribution of the species, melanism and in Southeast Asia where melanism is most frequent. The main differences between the control model, melanism model and southeast Asia models pertained to predictors related to precipitation, radiation and moisture (Figure 5), all of which are associated with rain/moist forests. It is therefore quite possible that the environmental variables that are most related to the occurrence of melanism are in fact only tracking the presence of moist forests, which may in itself be the driving agent selecting for this phenotype.

Given the observed support for an increased frequency of melanism in moist forests areas, it is interesting to discuss its potential causes in the light of classical hypotheses suggesting a selective advantage related to camouflage/ambush [9] or to thermoregulation [60]. It is also noteworthy that this result is different from what we observed in jaguars (a species that is closely related to leopards, with a similar melanistic variant and somewhat similar ecological requirements), in which the presence of melanism does not seem to be significantly associated with moist forests, but there seems to be an effect of negative selection in open/flooded areas, possibly related to thermoregulation [see chapter 2]. However, it is important to note that the Maxent model is based on predictors and their relative importance. It is therefore important to be cautious and not to disregard the possibility that some relevant predictor may have been lost in the selection of variables by Pearson's test, or that another important predictor was not measured or contemplated in the initial analysis. In this context, it is relevant to point out that when we removed the samples from Java (*P. p. melas*) and ran the model again (not shown), using the same variables and configuration of the control model and melanism model, the output map maintained high probabilities of black leopards occurring in Java. The same result was obtained when we removed the confirmed melanistic animal from Africa (*P. p. pardus*), with the model still indicating a high probability of melanism at the sample location. Such observations lend confidence to the reliability of the models generated in this study.

After over 100 years of anecdotal appearances in the scientific and popular literature, but no direct assessment with rigorous approaches, this study has provided a characterization of the spatial distribution of melanism in leopards, and demonstrated that such distribution is non-random. While its association with moist forests and its significant decrease in open/dry habitats support classical adaptive hypotheses, many other questions remain unanswered, such as the exact selective agents and mechanisms acting upon this phenotype, as well as the interaction of selection and drift at a regional level. The results and analyses reported here should hopefully serve as a useful basis for studies addressing these questions, shedding further light on the ecological and evolutionary dynamics of such a remarkable coloration variant.

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APPENDICES

Supplementary table 1 - Location records for *Panthera pardus* (pdf).

***Apêndice 3**

TABLE AND FIGURE CAPTIONS

Table 1 – Distribution of non-melanistic and melanistic leopards in different landscape types (biomes and ecoregions) across the species' range. Ecoregions listed in red font indicate the presence of melanistic individuals.

Table 2 – Association test of landscape variables (biomes) with groups of samples (non-melanistic/melanistic). An adjusted residual >2 or <-2 indicates statistical significance for alpha=0.05.

Figure 1 – Coat color patterns in *Panthera pardus*: (A) Non-melanistic ('wild-type') coloration; (B) Melanistic coloration. Photos: Bruce Kekule.

Figure 2 – Location of the samples analyzed in this study, overlaid on a map of terrestrial biomes.

Figure 3 – Map depicting the delimitation of presently recognized leopard subspecies (based on reference [33]), including the distribution of melanistic and non-melanistic samples used in the present study, as well as an indication of regions in which our database enabled an extension of the known species range, relative to the current IUCN map.

Figure 4 – Potential distribution maps of leopards: (A) Distribution of the species as a whole (control model) and (B) Distribution of melanism (melanism model).

Figure 5 – Relative importance for each predictor used in the models (%): Control model (yellow), Melanism (black) and Southeast Asia (green).

TABLES AND FIGURES

Table 1

Biome	Ecoregion	Samples (S=Non-melanistic / D = Doubtful melanistic / M=Melanistic)	Total Biome
Desert and Xeric Shrublands	Arabian Highlands woodlands and shrublands	9 (9S)	69 (69S)
	Azerbaijan shrub desert and steppe	1 (1S)	
	Caspian lowland desert	2 (2S)	
	Central Persian desert basins	13 (13S)	
	Deccan thorn scrub forests	6 (6S)	
	Kalahari xeric savanna	26 (26S)	
	Masai xeric grasslands and shrublands	1 (1S)	
	Namibian savanna woodlands	2 (2S)	
	Namib-Karoo-Kaokoveld Deserts and Shrublands	3 (3S)	
	Northwestern thorn scrub forests	1 (1S)	
	Red Sea Nubo-Sindian tropical desert and semi-desert	1 (1S)	
	South Iran Nubo-Sindian desert and semi-desert	4 (4S)	
Mediterranean Forests, Woodlands, and Scrub	Fynbos	8 (8S)	13 (13S)
	Lowland fynbos and renosterveld	2 (2S)	
	Montane fynbos and renosterveld	3 (3S)	
Tundra	Suiphun-Khanka meadows and forest meadows	2 (2S)	2 (2S)
Montane Grasslands and Shrublands	Drakensberg Montane Woodlands and Grasslands	28 (27S / 1D)	**51 (47S / 1D / 3M)**
	Eastern Himalayan alpine meadows	**1 (1M)**	
	Eastern Himalayan alpine shrub and meadows	**1 (1M)**	
	Ethiopian Highlands	1 (1S)	
	Ethiopian montane grasslands and woodlands	**1 (1M)**	
	Kopet Dag woodlands and forest steppe	4 (4S)	
	Kuh Rud and Eastern Iran montane woodlands	5 (5S)	
	Middle Asian montane woodlands and steppe	1 (1S)	
	Southeast Tibet shrublands and meadows	3 (3S)	
	Tibetan Plateau steppe	2 (2S)	
	Western Himalayan alpine shrub and Meadows	4 (4S)	
Temperate Broadleaf and Mixed Forests	Caspian Hyrcanian mixed forests	4 (4S)	**111 (108S / 3M)**
	Caucasus mixed forests	1 (1S)	
	Caucasus-Anatolian-Hyrcanian temperate forests	2 (2S)	
	Central China loess plateau mixed forests	3 (3S)	
	Changjiang Plain evergreen forests	3 (3S)	
	Eastern Himalayan broadleaf forests	**6 (3S / 3M)**	
	Manchurian mixed forests	74 (74S)	
	Sichuan Basin evergreen broadleaf forests	3 (3S)	
	Western Himalayan broadleaf forests	4 (4S)	
	Zagros Mountains forest steppe	11 (11S)	
Temperate Coniferous Forest	Caucasus-Anatolian-Hyrcanian temperate forests	3 (2S / 1D)	6 (5S / 1D)
	Hengduan Shan conifer forests	2 (2S)	
	Western Himalayan temperate forests	1 (1S)	
Temperate Grasslands, Savannas and Shrublands	Eastern Anatolian montane steppe	2 (2S)	2 (2S)
Tropical and Subtropical Coniferous Forests	Himalayan subtropical pine forests	5 (5S)	5 (5S)
Tropical and Subtropical Dry Broadleaf Forests	Central Deccan Plateau dry deciduous forests	2(2S)	**40 (38S / 2M)**
	Central Indochina dry forests	2 (2S)	
	Indochina dry forests	**4 (3S / 1M)**	
	Khathiar-Gir dry deciduous forests	9 (9S)	
	Narmada Valley dry deciduous forests	**1 (1M)**	
	South Deccan Plateau dry deciduous forests	1 (1S)	
	Southeastern Indochina dry evergreen forests	2 (2S)	
	Sri Lanka dry-zone dry evergreen forests	19 (19S)	
Tropical and Subtropical Grasslands, Savannas and Shrublands	Angolan Mopane woodlands	6 (6S)	127 (126S / 1D)
	Central Zambezian Miombo woodlands	5 (5S)	
	East African Acacia Savannas	28 (27S / 1D)	
	East Sudanian savanna	1 (1S)	
	Eastern Miombo woodlands	2 (2S)	
	Guinean forest-savanna mosaic	1 (1S)	
	Kalahari Acacia-Baikiaea woodlands	18 (18S)	
	Northern Congolian forest-savanna mosaic	21 (21S)	
	Sahelian Acacia savanna	1 (1S)	
	Southern Africa bushveld	5 (5S)	
	Southern Congolian forest-savanna mosaic	2 (2S)	
	Southern Miombo woodlands	5 (5S)	
	Terai-Duar savanna and grasslands	1 (1S)	
	Victoria Basin forest-savanna mosaic	5 (5S)	
	West Sudanian savanna	2 (2S)	
	Western Congolian forest-savanna mosaic	5 (5S)	
	Zambezian and Mopane woodlands	16 (16S)	
	Zambezian Baikiaea woodlands	3 (3S)	
Tropical and Subtropical Moist Broadleaf Forest	Annamite Range moist forests	1 (1S)	**197 (137S / 1D / 59M)**
	Brahmaputra Valley semi-evergreen forests	**21 (17S / 4M)**	
	Chao Phraya freshwater swamp forests	**1 (1M)**	
	Chao Phraya lowland moist deciduous forests	**2 (2M)**	
	Congolian Coastal Forests	6 (6S)	
	East African montane forests	4 (3S / 1D)	
	Eastern Arc Montane Forests	1 (1S)	
	Eastern Deccan plateau moist forests	4 (4S)	
	Eastern highlands moist deciduous forests	**6 (2S / 4M)**	
	Eastern Java-Bali rain forests	**3 (2S / 1M)**	
	Ethiopian montane forests	1 (1S)	
	Guinean Moist Forests	1 (1S)	
	Guizhou Plateau broadleaf and mixed forests	1 (1S)	
	Himalayan subtropical broadleaf forests	7 (7S)	
	Kayah-Karen/Tenasserim moist forests	**37 (21S / 16M)**	
	Malabar Coast moist forests	**7 (6S / 1M)**	
	Meghalaya subtropical forests	2 (2S)	
	Niger Delta swamp forests	2 (2S)	
	North Indochina subtropical moist forests	2 (2S)	
	North Western Ghats moist deciduous forests	**6 (4S / 2M)**	
	North Western Ghats montane rain forests	2 (2S)	
	Northeastern Congo Basin moist forests	6 (6S)	
	Northern Zanzibar-Inhambane coastal forest mosaic	3 (3S)	
	Northwestern Congolian lowland forests	2 (2S)	
	Peninsular Malaysian rain forests	**21 (2S / 19M)**	
	South Western Ghats moist deciduous forests	**2 (2M)**	
	Southeast China-Hainan moist forests	7 (7S)	
	Southwestern Ghats moist forest	3 (3S)	
	Sri Lankan moist forest	**7 (6S / 1M)**	
	Upper Gangetic Plains moist deciduous forests	10 (10S)	
	Western Congo Basin moist forests	7 (7S)	
	Western Java montane rain forests	**4 (4M)**	
	Western Java rain forests	**8 (6S / 2M)**	

Table 2

Biome	Statistics	Leopard Groups		Total
		Non-melanistic	Melanistic	
Desert and Xeric Shrublands	Count	69	0	69
	Expected	61.5	7.5	69.0
	% within landscape	100.0%	0.0%	100.0%
	% within groups	12.5%	0.0%	11.1%
	% of Total	11.1%	0.0%	11.1%
	Adjusted Residual	3.1	-3.1	
Mediterranean Forests. Woodlands. and Scrub	Count	13	0	13
	Expected	11.6	1.4	79
	% within landscape	100.0%	0.0%	100.0%
	% within groups	2.4%	0.0%	2.1%
	% of Total	2.1%	0.0%	2.1%
	Adjusted Residual	1.3	-1.3	
Tundra	Count	2	0	2
	Expected	1.8	0.2	2.0
	% within landscape	100.0%	0.0%	100.0%
	% within groups	0.4%	0.0%	0.3%
	% of Total	0.3%	0.0%	0.3%
	Adjusted Residual	0.5	-0.5	
Montane Grasslands and Shrublands	Count	47	3	50
	Expected	44.6	5.4	50.0
	% within landscape	94.0%	6.0%	100.0%
	% within groups	8.5%	4.5%	8.1%
	% of Total	7.6%	0.5%	8.1%
	Adjusted Residual	1.1	-1.1	
Temperate Broadleaf and Mixed Forests	Count	108	3	111
	Expected	99.0	12.0	111.0
	% within landscape	97.3%	2.7%	1
	% within groups	19.6%	4.5%	17.9%
	% of Total	17.4%	0.5%	17.9%
	Adjusted Residual	3	-3	
Temperate Coniferous Forest	Count	5	0	5
	Expected	4.5	0.5	5.0
	% within landscape	100.0%	0.0%	100.0%
	% within groups	0.9%	0.0%	0.8%
	% of Total	0.8%	0.0%	0.8%
	Adjusted Residual	0.8	-0.8	
Temperate Grasslands. Savannas and Shrublands	Count	2	0	2
	Expected	1.8	0.2	2.0
	% within landscape	100.0%	0.0%	100.0%
	% within groups	0.4%	0.0%	0.3%
	% of Total	0.3%	0.0%	0.3%
	Adjusted Residual	0.5	-0.5	
Tropical and Subtropical Coniferous Forests	Count	5	0	5
	Expected	4.5	0.5	5.0
	% within landscape	100.0%	0.0%	100.0%
	% within groups	0.9%	0.0%	0.8%
	% of Total	0.8%	0.0%	0.8%
	Adjusted Residual	0.8	-0.8	
Tropical and Subtropical Dry Broadleaf Forests	Count	38	2	40
	Expected	35.7	4.3	40.0
	% within landscape	95.0%	5.0%	100.0%
	% within groups	6.9%	3.0%	6.5%
	% of Total	6.1%	0.3%	6.5%
	Adjusted Residual	1.2	-1.2	
Tropical and Subtropical Grasslands. Savannas and Shrublands	Count	126	0	126
	Expected	112.4	13.6	126.0
	% within landscape	100.0%	0.0%	100.0%
	% within groups	22.8%	0.0%	20.4%
	% of Total	20.4%	0.0%	20.4%
	Adjusted Residual	4.4	-4.4	
Tropical and Subtropical Moist Broadleaf Forest	Count	137	59	196
	Expected	174.8	21.2	196.0
	% within landscape	69.9%	30.1	100.0
	% within groups	24.8%	88.1%	31.7%
	% of Total	22.1%	9.5%	31.7%
	Adjusted Residual	-10.5	10.5	
	Count	552	67	196
	% of Total	89.2%	10.8%	100.0%

Chi-square = 112.608, likelihood ratio = 118.450, linear-bylinear association = 43.897; with 619 valid cases.

Figure 1

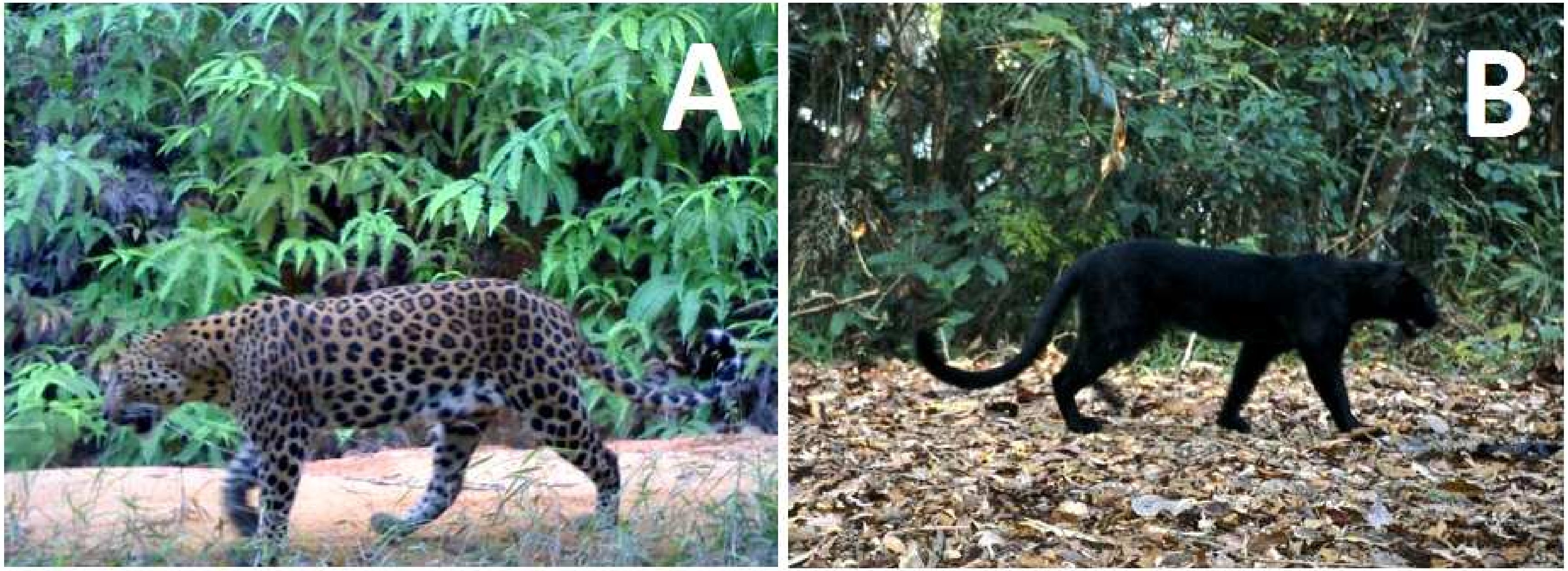


Figure 2

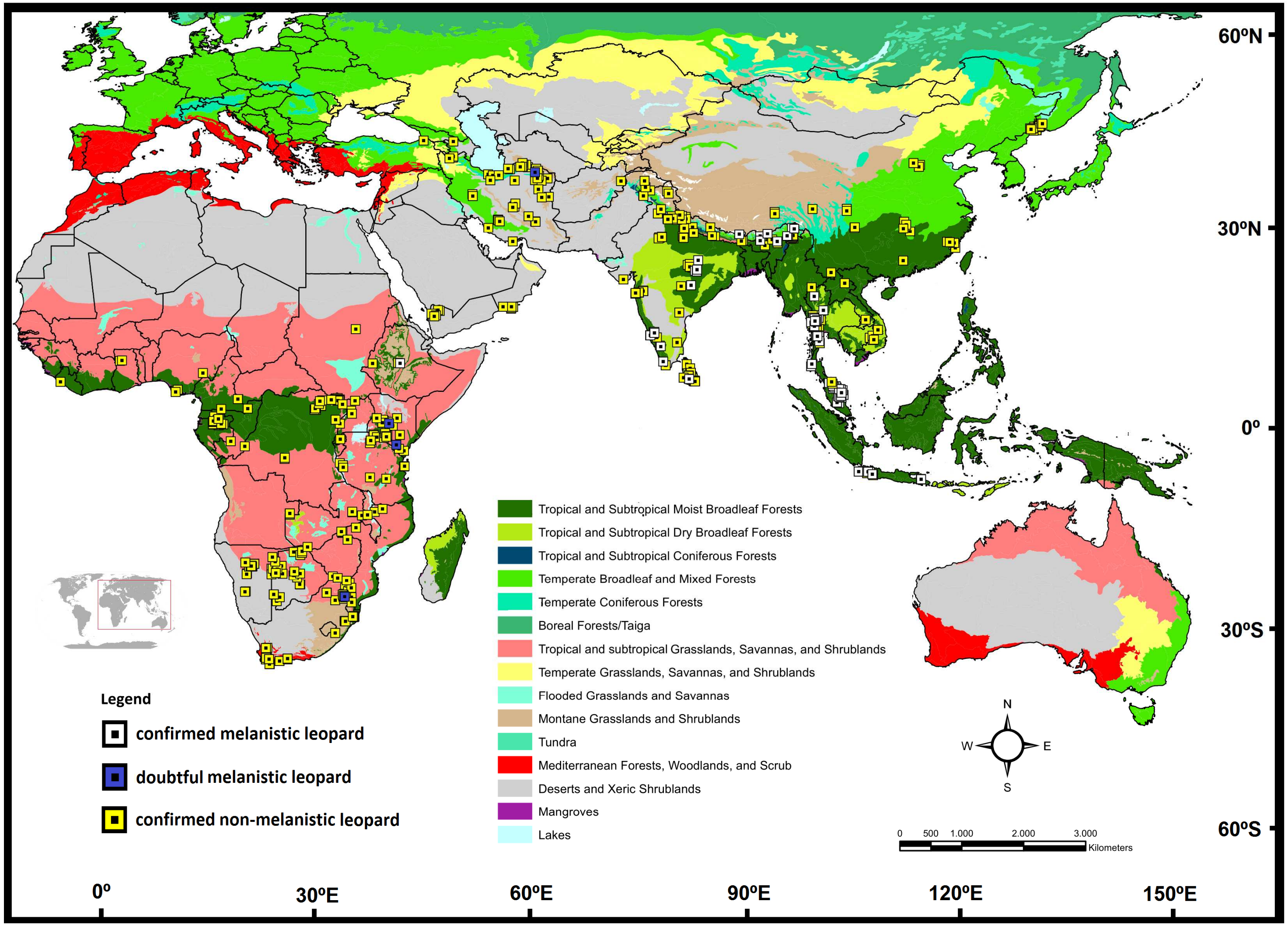
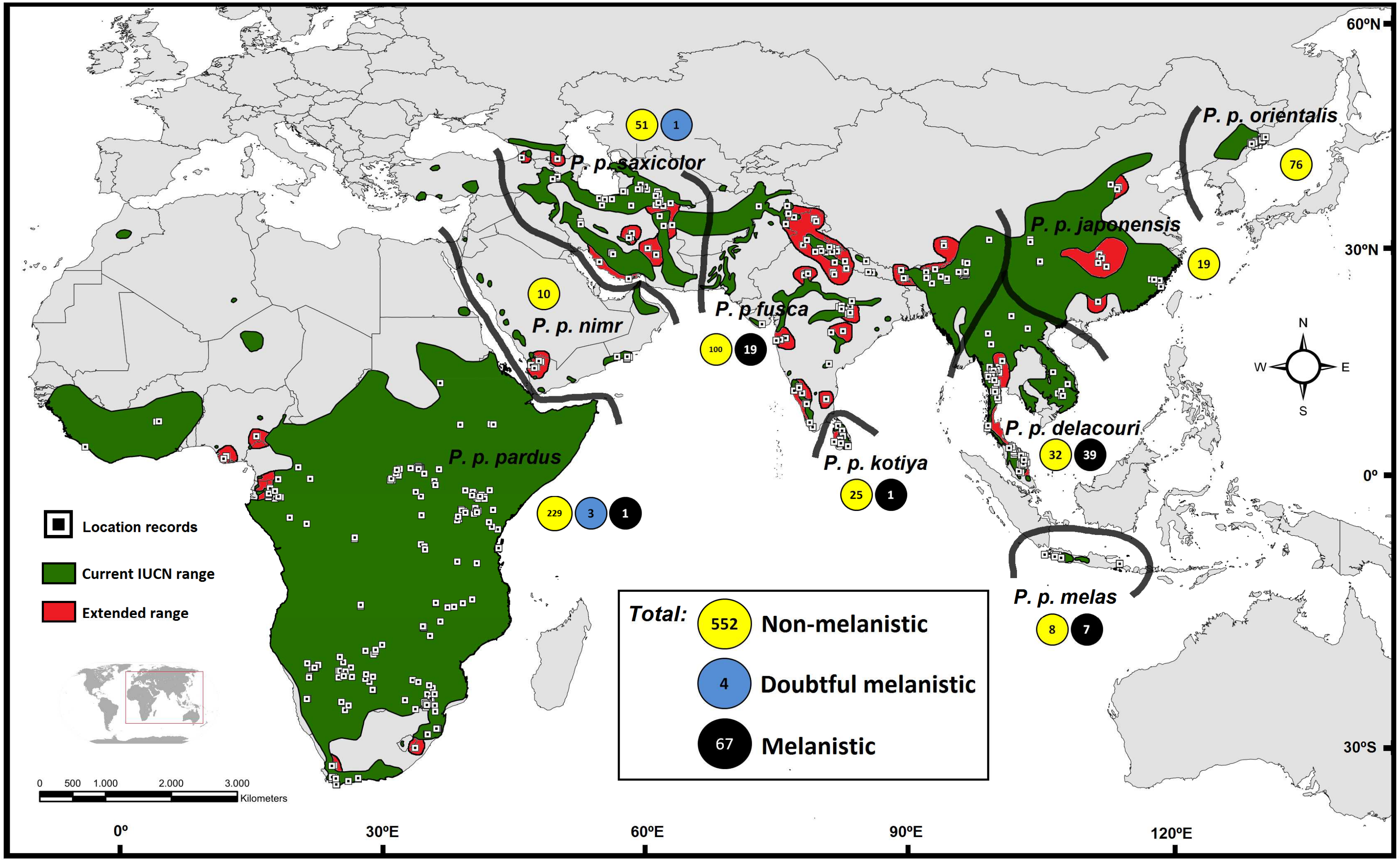

60ºN
30ºN
0º
30ºS
60ºS
0º
30ºE
60ºE
90ºE
120ºE
150ºE
Tropical and Subtropical Moist Broadleaf Forests
Tropical and Subtropical Dry Broadleaf Forests
Tropical and Subtropical Coniferous Forests
Temperate Broadleaf and Mixed Forests
Temperate Coniferous Forests
Boreal Forests/Taiga
Tropical and subtropical Grasslands, Savannas, and Shrublands
Temperate Grasslands, Savannas, and Shrublands
Flooded Grasslands and Savannas
Montane Grasslands and Shrublands
Tundra
Mediterranean Forests, Woodlands, and Scrub
Deserts and Xeric Shrublands
Mangroves
Lakes
Legend
confirmed melanistic leopard
doubtful melanistic leopard
confirmed non-melanistic leopard
N
W
E
S
0 500 1.000 2.000 3.000
Kilometers

Figure 3



60ºN
30ºN
0º
30ºS
0º
30ºE
60ºE
90ºE
120ºE
P. p. saxicolor
51
1
P. p. orientalis
76
P. p. japonensis
19
P. p. nimr
10
P. p fusca
100
19
P. p. delacouri
32
39
P. p. kotiya
25
1
P. p. pardus
229
3
1
P. p. melas
8
7
N
W
E
S
Location records
Current IUCN range
Extended range
0 500 1.000 2.000 3.000
Kilometers
Total:
552 Non-melanistic
4 Doubtful melanistic
67 Melanistic

Figure 4

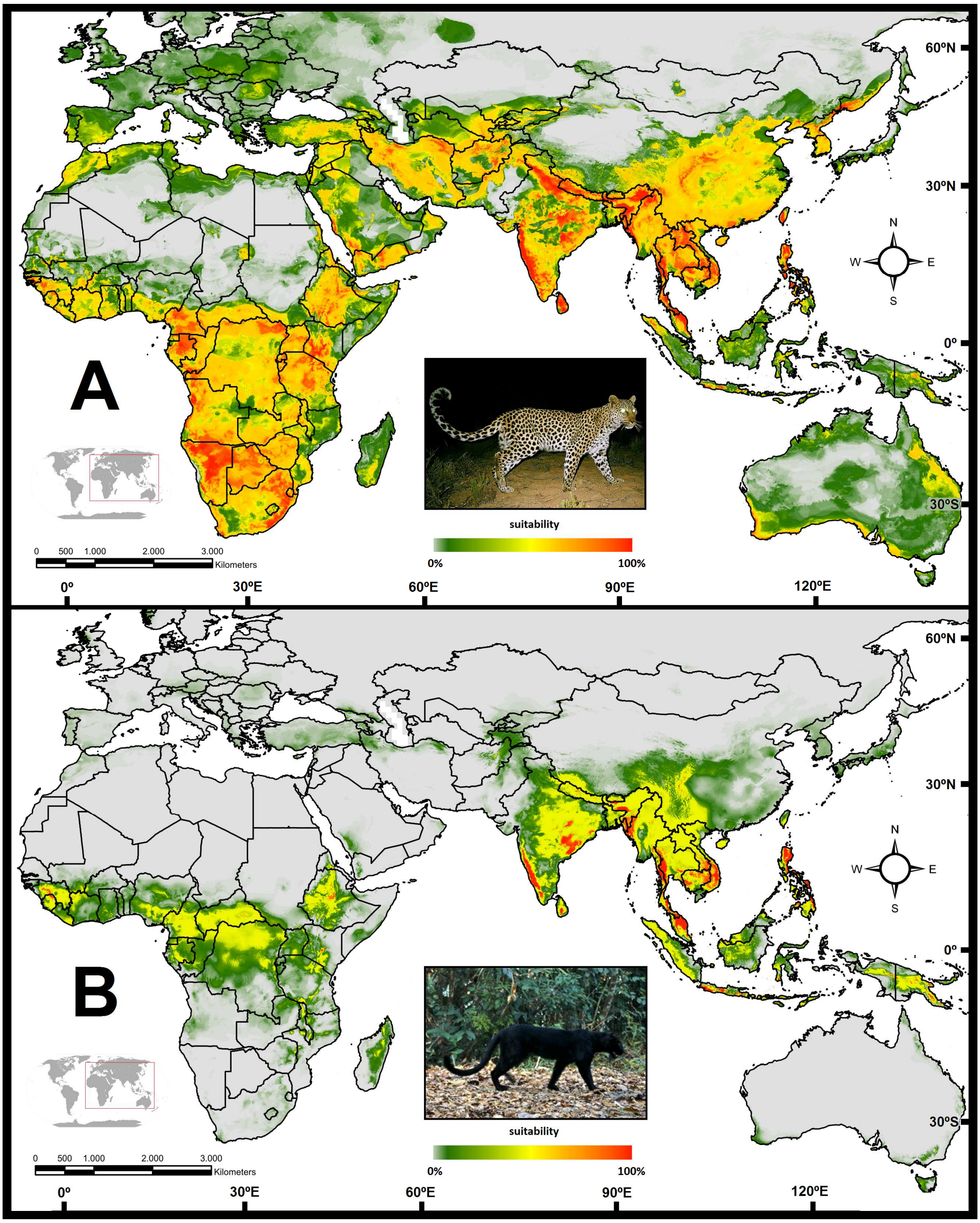
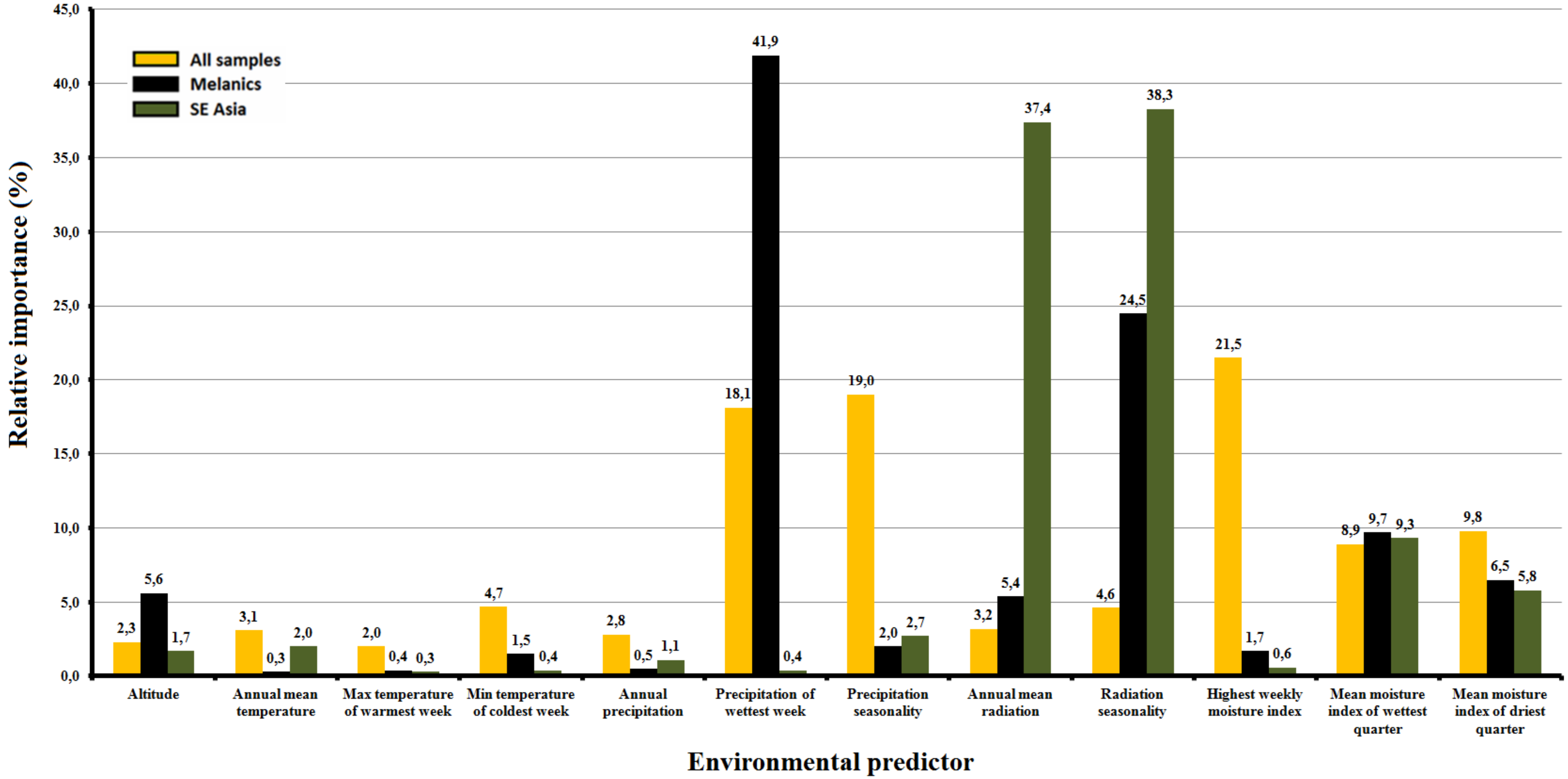

A
60ºN
30ºN
0º
30ºS
N
W
E
S
suitability
0%
100%
0
500
1.000
2.000
3.000
Kilometers
0º
30ºE
60ºE
90ºE
120ºE
B
60ºN
30ºN
0º
30ºS
N
W
E
S
suitability
0%
100%
0
500
1.000
2.000
3.000
Kilometers
0º
30ºE
60ºE
90ºE
120ºE

Figure 5



All samples
Melanics
SE Asia
Relative importance (%)
45,0
40,0
35,0
30,0
25,0
20,0
15,0
10,0
5,0
0,0
2,3
5,6
1,7
3,1
0,3
2,0
2,0
0,4
0,3
4,7
1,5
0,4
2,8
0,5
1,1
18,1
41,9
0,4
19,0
2,0
2,7
3,2
5,4
37,4
4,6
24,5
38,3
21,5
1,7
0,6
8,9
9,7
9,3
9,8
6,5
5,8
Altitude
Annual mean temperature
Max temperature of warmest week
Min temperature of coldest week
Annual precipitation
Precipitation of wettest week
Precipitation seasonality
Annual mean radiation
Radiation seasonality
Highest weekly moisture index
Mean moisture index of wettest quarter
Mean moisture index of driest quarter
Environmental predictor

CAPÍTULO 5:

DISCUSSÃO GERAL

Para elaborar modelos computacionais de distribuição espacial do melanismo em *P. onca*, *P. pardus* e *P. yagouaroundi* em função de condicionantes ambientais, e propôr mapas de distribuição presumida do melanismo nessas três espécies ao longo de suas distribuições geográficas, foi necessária a compilação de dados georreferenciados de várias fontes distintas, englobando métodos invasivos e não invasivos. O banco de amostras compreendeu indivíduos provenientes de capturas de animais vivos, imagens de armadilhas fotográficas, peles depositadas em coleções científicas e amostras de DNA fecal. Somando-se os dados das três espécies, obtivemos quase dois mil pontos de ocorrência contendo informação de coloração para cada um destes indivíduos, o que pode ser considerado como um banco de dados muito expressivo para o estudo de variação fenotípica, principalmente em mastozoologia onde a obtenção de amostras em geral é bastante difícil. Por conta disso, além de servir de base para o estudo da distribuição e relevância adaptativa do melanismo, o banco de dados resultante atualiza as distribuições conhecidas atuais publicadas pela IUCN das três espécies em questão (Figura 5 desse presente capítulo para *P. onca* e *P. yagouaroundi* e Figura 3 do capítulo 4 para *P. pardus*).

Como citado anteriomente, os relatos anedóticos acerca da presença e a relevância adaptativa do melanismo em felinos selvagens são postulados muito antigos na literatura científica, porém o presente estudo pela primeira vez apresenta um mapa de distribuição geográfica para o melanismo em espécies representantes da família. Esse entendimento sobre a presença/ausência dos felinos melânicos expande significativamente o conhecimento, preenchendo uma lacuna de mais de 130 anos desde a citação bibliográfica de ocorrência das "panteras negras" (em referência aos leopardos melânicos) feita por Wallace (1877), após viagem pela Ásia. Ao mesmo tempo serve como base para teste de hipóteses sobre os padrões de distribuição e a influência de fatores bióticos e abióticos sobre esses padrões.

O presente estudo utilizou como hipótese nula a ideia de que o melanismo em felinos selvagens representa um polimorfismo de coloração neutro. Neste contexto, determinado fenótipo seletivamente neutro deve mostrar um padrão de variação aleatório entre populações demograficamente conectadas, enquanto padrões não aleatórios sugeririam a ação de seleção natural. Assim sendo, a existência de variação geográfica não aleatória dentro das espécies provavelmente é a maior fonte de evidência da existência de seleção natural, e distinguir esses padrões é o principal foco deste estudo. Portanto, foram consideradas duas hipóteses concorrentes: (I) O cenário esperado e considerado como nulo seria o melanismo presente em toda a área de distribuição de cada uma das espécies (ou ao menos no âmbito de regiões que apresentem conectividade genética e demográfica interna), ocorrendo de forma aleatória entre os ambientes (ou seja, ausência de qualquer associação com variáveis de paisagem ou parâmetros ambientais preditores da sua distribuição). Como hipótese concorrente consideramos: (II) O melanismo distribuído em função de parâmetros ambientais e/ou condicionantes biogeográficos (por exemplo, biomas ou ecorregiões). Nas três espécies analisadas, a distribuição do melanismo mostrou ser não aleatória, o que constituiu um resultado bastante relevante em cada um dos estudos aqui apresentados. As frequências observadas foram significativamente diferentes das esperadas em determinadas conformações da paisagem, levando-nos a assumir a hipótese concorrente como verdadeira, e sugerindo relevância adaptativa do melanismo em diferentes contextos ecológicos (possivelmente efeito de forças evolutivas históricas, especialmente da seleção natural, sobre a atual distribuição geográfica do melanismo nestes felinos).

Outro ponto interessante é o fato de que as diferentes espécies estudadas apresentaram distintos padrões geográficos. No caso de onças-pintadas, existe uma clara ausência do melanismo em conformações de paisagem (ecoregiões) abertas e periodicamente inundadas como o Pantanal e o Llanos, além de uma maior aparição de indivíduos melânicos na América do Sul, em comparação com áreas mais setentrionais da distribuição da espécie. Já nos leopardos, a presença do melanismo está diretamente associada a florestas úmidas tropicais e subtropicais, especialmente no sudeste da Ásia, apresentando alta frequência em algumas áreas (por exemplo, na Tailândia e Malásia ao sul do Istmo de Kra), corroborando um padrão já reportado anteriormente por Kawanishi *et al.* (2010). No jaguarundi, fica visível que o padrão fenotípico derivado (melânico) é mais comum na natureza do que o padrão ancestral (avermelhado). O padrão ancestral tem distribuição mais associada a conformações de paisagem onde predominam áreas abertas (Pampa, Chaco, Patagônia, Caatinga e áreas abertas das Américas Central e do Norte) e está ausente em regiões como a Amazônia, enquanto o fenótipo melânico está presente em todas as conformações de paisagem onde a espécie ocorre, não havendo um padrão evidente de associação a ecoregiões específicas. Todos esses resultados são apoiados por mapas de distribuição potencial gerados a partir dos algoritmos de análise comparados com modelos-controle, os quais utilizaram como base a totalidade das amostras do banco de dados. O melanismo em onças-pintadas, jaguarundis e leopardos deriva de três distintas e independentes mutações com padrões de herança dominante, semidominante e recessiva, respectivamente. Também espécies muito semelhantes e de diferente ocorrência geográfica como a onça-pintada e o leopardo apresentam padrões genéticos e de distribuição bem distintos em relação ao melanismo. Por isso, conectando os padrões geográficos encontrados neste estudo com as informações genéticas já conhecidas, pode-se levantar a possibilidade de que os mecanismos evolutivos que atuam nestas três espécies sejam distintos (por exemplo os agentes da seleção natural).

Além disso, a fim de interpretar os resultados que obtvemos nas análises de distribuição, utilizamos resultados de estudos paralelos em nível molecular já desenvolvidos por nosso grupo de pesquisa. Por exemplo, levamos em consideração as análises que levaram à identificaçao da mutação nos genes causadores do melanismo em onças-pintadas e jaguarundis (Eizirik *et al*., 2003), bem como em leopardos (Schneider *et al*., 2012), estudos de filogeografia de onças-pintadas (Eizirik *et al*., 2001) e de jaguarundis (Pires, 2012) e o trabalho ainda em andamento sobre a genética de populações de onças-pintadas em biomas brasileiros (especialmente no que tange ao fluxo gênico historico entre regiões como o Pantanal e a Mata Atlântica; Valdez [2010]). Além desses, também incorporamos os resultados do estudo de filogeografia de leopardo, desenvolvido por grupo de pesquisa parceiro (Uphyrkina *et al*., 2001). Desta forma, além de atender ao principal foco desta investigação, centrado na identificação de padrões geográficos de distribuição do melanismo, buscamos integrar os resultados de todos esses estudos para avaliar relevância adaptativa deste fenótipo, e hipotetizar sobre evidências da seleção natural atuando nas variantes de coloração avaliadas.

Os resultados também evidenciam o potencial da ferramenta de modelagem de nicho para gerar mapas de distribuição não só de espécies (como classicamente é utilizado), mas também para a prever distribuição de características e variações intraespecíficas, tais como fenótipos. Obtivemos ótimos resultados com os modelos, com altos valores de AUC para modelagens de grande escala geográfica (e consequentemente, com grande variação de valores absolutos dentro dos parâmetros preditores), com a utilização de um número reduzido de preditores minimizando problemas de correlação paramétrica (10-12 preditores dependendo da espécie focal). Talvez modelagens em escalas regional se mostrassem mais precisas em relação aos grupos-controle do presente estudo (tal como realizado por Ferraz *et al*. [2012] e Tôrres *et al*. [2012]), mas perderíamos a capacidade de análises comparativas entre os controles e os modelos de distribuição dos animais melânicos, o que nos parece justificar a opção pela abordagem realizada. Mesmo assim, foi possível identificar efeitos locais de deriva genética já inferidos para onças-pintadas (Parque Estadual do Morro do Diabo [São Paulo] e Parque Nacional da Serra da Capivara [Piauí], ambos no Brasil), bem como a aferir pontos duvidosos de ocorrência de leopardos melânicos. Também foi realizada a análise de distribuição do melanismo em leopardos tirando parte dos pontos de ocorrência confirmada de melanismo (por exemplo, África e Java) com a mesma configuração de modelagem, e os resultados continuavam apontando alta adequabilidade para a ocorrência do melanismo nessas áreas, corroborando a boa capacidade preditiva dos modelos gerados.

Aumentou-se também significativamente o conhecimento em relação aos possíveis parâmeros ambientais que podem influenciar a distribuição dos fenótipos, com sugestões de tendências de relação com camuflagem e termorregulação. Porém, algum preditor importante pode ter sido perdido quando das pré-análises visando à remoção do efeito de correlação, ou fatores ambientais bióticos podem não ter sido contemplados pelas análises (por exemplo: seleção natural dependente de frequências ou relações mais complexas entre predadores e presas que podem variar espacialmente). Desta forma, a questão dos parâmetros envolvidos diretamente na distribuição dos diferentes fenótipos na natureza ainda carece de novas investigações. A grande dificuldade é delinear um experimento que seja operacional e viável, em felinos selvagens, para testes da hipótese de seleção natural que avaliem a relação entre camuflagem, termorregulação e parâmetros abióticos e bióticos, tal como já realizados com alguns outros sistemas (por exemplo o estudo realizado por Hoekstra [2006]).

Em suma, o trabalho considerou aspectos de biogeografia história e biogeografia ecológica, baseando-se em técnicas modernas de ecologia para a análise da distribuição espacial do melanismo em felinos. Os resultados obtidos podem ser utilizados como suporte para o delineamento de novos experimentos e investigações acerca da variação de coloração animal. Especialmente em mamíferos, pode ser considerado como base para testes de hipóteses sobre deriva genética e seleção natural atuando em populações naturais, subsidiando projetos de conservação da diversidade de fenótipos polimórficos.

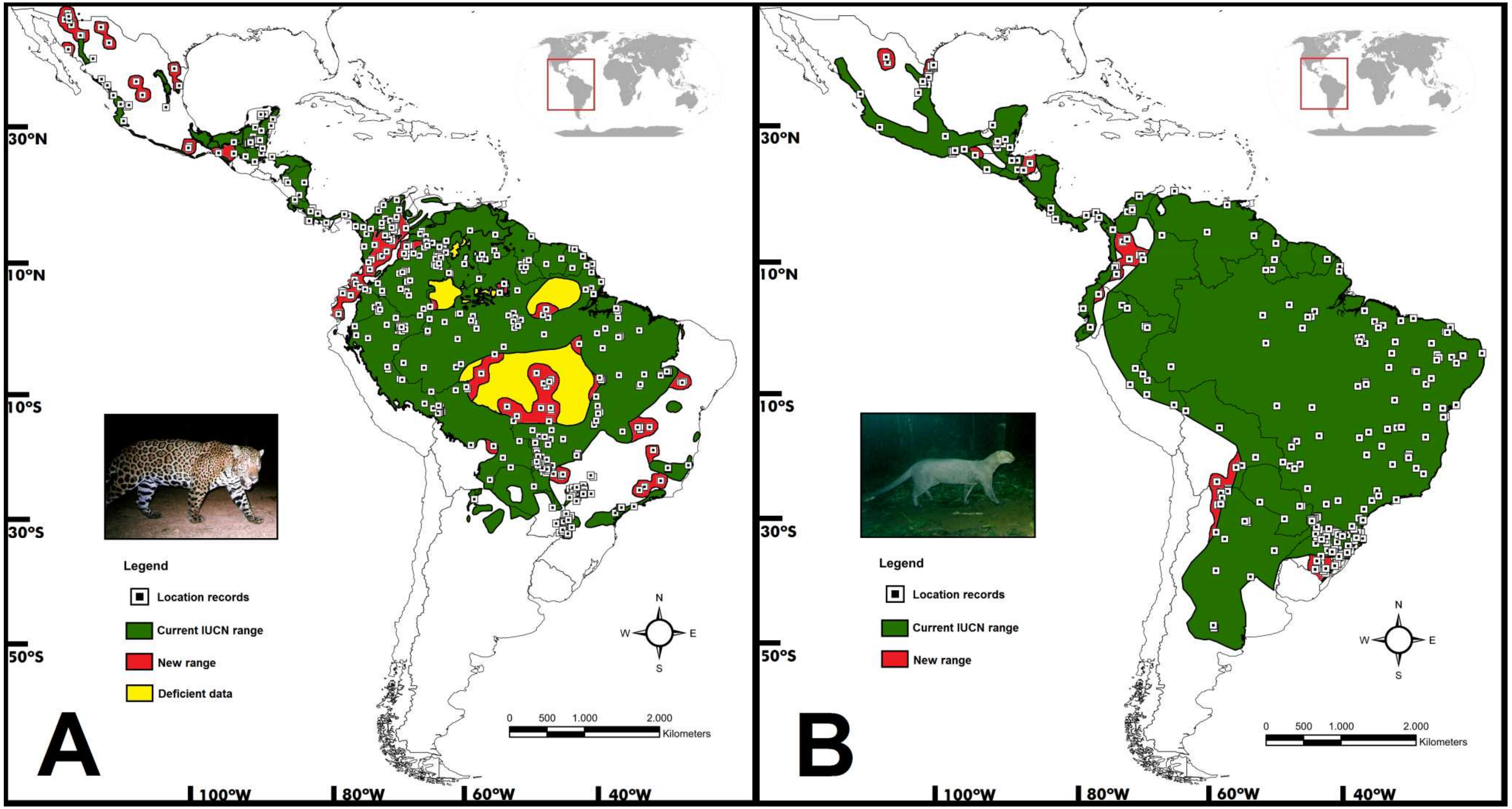
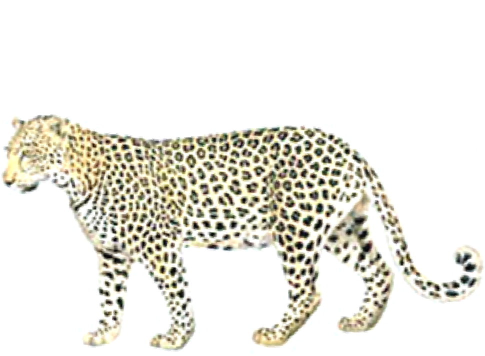


Figura 5 - Atualização da distribuição geográfica atual da onça-pintada (A) e do jaguarundi (B) com os dados obtidos no presente estudo. As áreas em vermelho representam regiões onde a ocorrência da espécie não se encontrava documentada na base de dados da IUCN, e para as quais nossos dados proveram confirmação de presença.



PERSPECTIVAS

A geração de mapas e modelos das áreas geográficas de ocorrência do melanismo, a avaliação de não aleatoriedade na distribuição deste fenótipo, e demais análises aqui realizadas visando testar a relevância adaptativa dessa característica fenotípica, compõem um campo bastante interessante dentro da pesquisa em outras espécies de felinos e também outros mamíferos. Adicionalmente ao banco de dados utilizado na composição do presente estudo, obtivemos registros de outras espécies que não foram contempladas nesse momento. Esse banco de dados adicional com procedências geográficas e informação de coloração de cada indivíduo conta com registros de *Lynx rufus* (lince-fulvo: 138 não-melânicos e 12 melânicos), complexo 'tigrinus' formado por *Leopardus tigrinus* e *Leopardus guttulus* (gato-do-mato-pequeno: 268 não-melânicos e 8 melânicos), *Leopardus geoffroyi* (gato-do-mato-grande: 102 não-melânicos e 24 melânicos), além de registros pontuais adicionais de indivíduos de ambos os fenótipos para *Leopardus guigna* (guiña), *Leopardus colocolo* (gato-palheiro), *Caracal serval* (serval) e *Pardofelis temminckii* (gato dourado asiático), totalizando 36 registros dessas quatro espécies. A complementação desse banco adicional de amostras com novos dados pode subsidiar mapas de distribuição e modelos para estudos futuros. Dentro dessa base de dados, alguns registros possuem material biológico disponível para estudos genéticos, visando a identificar a mutação causadora do melanismo naquelas espécies onde ela ainda não é conhecida. A perspectiva principal para os próximos anos é a identificação das mutações e a caracterização da distribuição geográfica do melanismo em todas as 13 espécies de felídeos em que essa variação fenotípica ocorre.

Além disso, uma segunda via de pesquisa futura é a melhoria dos modelos de distribuição de forma que possamos interpretar melhor os parâmetros ambientais preditores e identificar de forma clara efeitos de seleção natural sobre os fenótipos. A ferramenta de análise mostrou-se eficiente para esse propósito, e o teste com outras variações de pelagem e não somente o melanismo é uma temática bastante interessante, que pode dar origem a novas frentes de trabalho. Outra possibilidade é o teste desses modelos em outros grupos de carnívoros para os quais também temos acesso a dados semelhantes, como canídeos, mustelídeos e mefitídeos. Assim sendo, a melhoria dos modelos e seu teste com outros grupos de mamíferos, especialmente carnívoros, constituem um campo bastante promissor.

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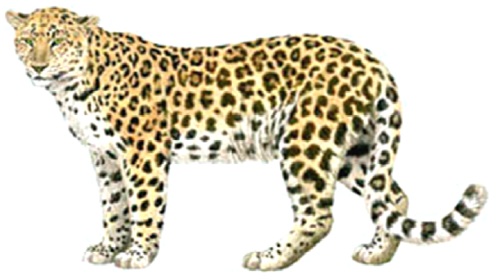

APÊNDICES:

APÊNDICE 1: TABELA SUPLEMENTAR CAPÍTULO 2

Registros *Panthera onca*

APÊNDICE 2: TABELA SUPLEMENTAR CAPÍTULO 3

Registros *Puma yagouaroundi*

APÊNDICE 3: TABELA SUPLEMENTAR CAPÍTULO 4

Registros *Panthera pardus*

APÊNDICE 1: TABELA SUPLEMENTAR CAPÍTULO 2

Registros *Panthera onca*

Supplementary table 1 - Location records for *Panthera onca* .

Samples	**Locality / Country**	**Deg-WGS84**		**Biome**	**Ecoregion**	**Sample type**	**Year**	**Information Source**
		Lat	**Long**					
Melanistic 01	Amanã, Amazonas, Brazil	-2,3309	-64,7553	Tropical and Subtropical Moist Broadleaf Forest	Japurá-Solimoes-Negro moist forests	Photograph	2012	Instituto Mamirauá Amazonas
Melanistic 02	Barreirinha de Baixo, Amazonas, Brazil	-2,1002	-66,4628	Tropical and Subtropical Moist Broadleaf Forest	Solimões-Japurá moist forests	Photograph	no data	Instituto Mamirauá Amazonas
Melanistic 03	South Manaus, Amazonas, Brazil	-3,4576	-59,6558	Tropical and Subtropical Moist Broadleaf Forest	Purus-Madeira moist forests	Photograph	2000	National Museum of Natural History USA
Melanistic 04	South Manaus, Amazonas, Brazil	-3,6729	-60,0753	Tropical and Subtropical Moist Broadleaf Forest	Purus-Madeira moist forests	Faecal DNA	2009	Instituto Mamirauá Amazonas
Melanistic 05	Uarina, Amazonas River, Brazil	-3,0520	-64,8400	Tropical and Subtropical Moist Broadleaf Forest	Purus varzeá	Photograph	2012	Instituto Mamirauá Amazonas
Melanistic 06	Uarina, Amazonas River, Brazil	-3,0230	-64,8570	Tropical and Subtropical Moist Broadleaf Forest	Purus varzeá	Photograph	2012	Instituto Mamirauá Amazonas
Melanistic 07	Uarina, Amazonas River, Brazil	-3,0290	-64,8700	Tropical and Subtropical Moist Broadleaf Forest	Purus varzeá	Capture	2012	Instituto Mamirauá Amazonas
Melanistic 08	Calçoene, Amapá, Brazil	2,6576	-51,3178	Tropical and Subtropical Moist Broadleaf Forest	Guianan moist forests	Report	no data	MPB Amapá Brazil
Melanistic 09	Calçoene, Amapá, Brazil	2,5853	-51,3416	Tropical and Subtropical Moist Broadleaf Forest	Guianan moist forests	Report	no data	MPB Amapá Brazil
Melanistic 10	Grande Sertão Veredas National Park, Bahia, Brazil	-14,9294	-45,7444	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Photograph	2010	Instituto Biotrópicos
Melanistic 11	Santo Sé, Bahia, Brazil	-9,9042	-40,9596	Desert and Xeric Shrublands	Caatinga	Photograph	2011	CENAP ICMBio
Melanistic 12	Aruanã, Goiás, Brazil	-14,2400	-50,7751	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Photograph	2006	Jaguar Conservation Fund
Melanistic 13	Araguaia River, Goiás, Brazil	-12,5554	-50,6030	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Photograph	1914	MUZUSP Brazil
Melanistic 14	Planaltina de Goiás, Brazil	-15,4606	-47,7707	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Report	2013	CENAP ICMBio
Melanistic 15	Reserva Extrativista Lago do Cedro, Goiás, Brazil	-14,7378	-51,0169	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Report	2012	ICMBio Brazil
Melanistic 16	Grande Sertão Veredas National Park, Minas Gerais, Brazil	-14,9056	-45,7404	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Photograph	2012	Instituto Biotrópicos
Melanistic 17	Grande Sertão Veredas National Park, Minas Gerais, Brazil	-14,9741	-46,0273	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Photograph	2010	Instituto Biotrópicos
Melanistic 18	Grande Sertão Veredas National Park, Minas Gerais, Brazil	-15,2730	-45,8167	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Report	2010	Instituto Biotrópicos
Melanistic 19	Grande Sertão Veredas National Park, Minas Gerais, Brazil	-15,2608	-45,8156	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Report	2010	Instituto Biotrópicos
Melanistic 20	Grande Sertão Veredas National Park, Minas Gerais, Brazil	-14,9861	-45,7900	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Report	2010	Instituto Biotrópicos
Melanistic 21	Grande Sertão Veredas National Park, Minas Gerais, Brazil	-14,9753	-45,8067	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Report	2010	Instituto Biotrópicos
Melanistic 22	Rio Doce State Park, Minas Gerais, Brazil	-19,6031	-42,6046	Tropical and Subtropical Moist Broadleaf Forest	Bahia coastal forests	Photograph	1999	UFMG Brazil
Melanistic 23	Fazenda Ariranha, Bataguassu, Mato Grosso do Sul, Brazil	-21,9861	-52,3772	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Photograph	2006	CENAP ICMBio
Melanistic 24	Ivinhema, Mato Grosso do Sul, Brazil	-22,8928	-53,7335	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Capture	2002	Instituto de Pesquisas Ecológicas
Melanistic 25	Nova Andradina, Mato Grosso do Sul, Brazil	-21,8890	-53,4247	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Photograph	2005	IBAMA
Melanistic 26	Porto Primavera, Mato Grosso do Sul, Brazil	-22,4354	-53,3634	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Photograph	1992	CENAP ICMBio
Melanistic 27	Porto Primavera, Mato Grosso do Sul, Brazil	-22,7808	-53,5068	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Photograph	1992	CENAP ICMBio
Melanistic 28	Porto Primavera, Mato Grosso do Sul, Brazil	-22,9678	-53,7775	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Photograph	1994	CENAP ICMBio
Melanistic 29	Porto Primavera, Fazenda Guatemala, Anaurilândia, Mato Grosso do Sul, Brazil	-22,3941	-52,9452	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Capture	1994	CENAP ICMBio
Melanistic 30	Taquarussu, Ivinhema, Mato Grosso do Sul, Brazil	-22,7449	-53,4828	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Capture	2005	Instituto de Pesquisas Ecológicas
Melanistic 31	Alta Floresta, Mato Grosso, Brazil	-9,7995	-56,0909	Tropical and Subtropical Moist Broadleaf Forest	Madeira-Tapajós moist forests	Capture	2012	CENAP ICMBio
Melanistic 32	Diauarum, São Felix do Araguaia, Mato Grosso, Brazil	-11,4984	-50,7689	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Photograph	2009	Jaguar Conservation Fund
Melanistic 33	Carajás, Pará, Brazil	-5,9867	-50,0275	Tropical and Subtropical Moist Broadleaf Forest	Xingu-Tocantins-Araguaia moist forests	Photograph	1992	CENAP ICMBio
Melanistic 34	Sacará-Taquera National Forest, Porto Trombetas, Pará, Brazil	-1,5571	-56,4643	Tropical and Subtropical Moist Broadleaf Forest	Uatuma-Trombetas moist forests	Photograph	no data	Jaguar Conservation Fund
Melanistic 35	Juruti, Ramal do Pacoval, Pará, Brazil	-2,5282	-56,2265	Tropical and Subtropical Moist Broadleaf Forest	Madeira-Tapajós moist forests	Photograph	no data	UFPA Brazil
Melanistic 36	Cantão National Park, Pará, Brazil	-9,6690	-50,1626	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Report	2006	Jaguar Conservation Fund
Melanistic 37	Cantão National Park, Pará, Brazil	-9,5724	-50,2675	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Report	2005	Jaguar Conservation Fund
Melanistic 38	Santana do Araguaia, Pará, Brazil	-9,3347	-50,3698	Tropical and Subtropical Moist Broadleaf Forest	Xingu-Tocantins-Araguaia moist forests	Photograph	no data	Pedro Martinelli
Melanistic 39	Serra da Capivara National Park, Piauí, Brazil	-8,7586	-42,5120	Desert and Xeric Shrublands	Caatinga	Photograph	2007	UNB Brazil
Melanistic 40	Serra da Capivara National Park, Piauí, Brazil	-8,7736	-42,5245	Desert and Xeric Shrublands	Caatinga	Photograph	2007	UNB Brazil
Melanistic 41	Serra da Capivara National Park, Piauí, Brazil	-8,6941	-42,5377	Desert and Xeric Shrublands	Caatinga	Photograph	2007	UNB Brazil
Melanistic 42	Serra da Capivara National Park, Piauí, Brazil	-8,6058	-42,6074	Desert and Xeric Shrublands	Caatinga	Photograph	2007	UNB Brazil
Melanistic 43	Serra da Capivara National Park, Piauí, Brazil	-8,8590	-42,6301	Desert and Xeric Shrublands	Caatinga	Photograph	2007	Jaguar Conservation Fund
Melanistic 44	Serra da Capivara National Park, Piauí, Brazil	-8,5804	-42,7000	Desert and Xeric Shrublands	Caatinga	Photograph	2010	Jaguar Conservation Fund
Melanistic 45	Serra da Capivara National Park, Piauí, Brazil	-8,7825	-42,6190	Desert and Xeric Shrublands	Caatinga	Photograph	2010	Jaguar Conservation Fund
Melanistic 46	Serra da Capivara National Park, Piauí, Brazil	-8,7121	-42,6117	Desert and Xeric Shrublands	Caatinga	Photograph	2009	Jaguar Conservation Fund
Melanistic 47	Serra da Capivara National Park, Piauí, Brazil	-8,6378	-42,7124	Desert and Xeric Shrublands	Caatinga	Report	2009	Jaguar Conservation Fund
Melanistic 48	Serra da Capivara National Park, Piauí, Brazil	-8,7755	-42,5375	Desert and Xeric Shrublands	Caatinga	Report	2007	Jaguar Conservation Fund
Melanistic 49	Alto Parará, Paraná, Brazil	-22,9562	-52,8840	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Capture	1999	Instituto de Pesquisas Ecológicas
Melanistic 50	Palmeiras, Guajará Mirim, Rondônia, Brazil	-10,6354	-65,4040	Tropical and Subtropical Moist Broadleaf Forest	Madeira-Tapajós moist forests	Faecal DNA	2007	Parque Ambiental Chico Mendes
Melanistic 51	Ilha Solteira, São Paulo, Brazil	-20,4591	-51,3745	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Faecal DNA	2007	Goiânia Zoo
Melanistic 52	Maraba Paulista, São Paulo, Brazil	-22,0872	-52,1191	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Capture	1998	Rio de Janeiro Zoo
Melanistic 53	Morro do Diabo State Park, São Paulo, Brazil	-22,4973	-52,2896	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Capture	1998	Instituto de Pesquisas Ecológicas
Melanistic 54	Morro do Diabo State Park, São Paulo, Brazil	-22,6278	-52,1679	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Capture	2003	Instituto de Pesquisas Ecológicas
Melanistic 55	Morro do Diabo State Park, São Paulo, Brazil	-22,5751	-52,3421	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Photograph	no data	Instituto de Pesquisas Ecológicas
Melanistic 56	Morro do Diabo State Park, São Paulo, Brazil	-22,6326	-52,2685	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Capture	2003	Instituto de Pesquisas Ecológicas
Melanistic 57	Ek Balam Cueva del Tigre Negro, Yucatan, Belize	17,7454	-88,9941	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	1970	Meyer, 1994

Samples	Locality / Country	Deg-WGS84		Biome	Ecoregion	Sample type	Year	Information Source
		Lat	Long					
Melanistic 58	Rancho Grande River, Belize	16,7900	-88,7200	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	no data	National Museum of Natural History USA
Melanistic 59	Reserva Biológica El Amargal, Nuquí, Departamento de Chocó, Colombia	5,6423	-77,1498	Tropical and Subtropical Moist Broadleaf Forest	South American Pacific mangroves	Report	2011	Panthera
Melanistic 60	Rio Calderón, Amazonas, Colombia	-4,0058	-69,9172	Tropical and Subtropical Moist Broadleaf Forest	Solimões-Japurá moist forests	Photograph	2007	Panthera
Melanistic 61	Tiputini Biological Station, Equador	0,0439	-78,6811	Tropical and Subtropical Moist Broadleaf Forest	Northwestern Andean montane forests	Photograph	no data	National Museum of Natural History USA
Melanistic 62	El Fuerte River, Sinaloa, Mexico	27,0077	-108,0114	Tropical and Subtropical Dry Broadleaf Forest	Sinaloan dry forests	Photograph	2007	Dinets & Polechla 2007
Melanistic 63	Napo Reserve, Peru	-1,5908	-75,3493	Tropical and Subtropical Moist Broadleaf Forest	Napo moist forests	Photograph	2008	National Museum of Natural History USA
Melanistic 64	Tamshiyacu, Peru	-4,0313	-73,0035	Tropical and Subtropical Moist Broadleaf Forest	Southwest Amazon moist forests	Photograph	2002	Panthera
Melanistic 65	Beni River, Bolivia	-10,4024	-65,5274	Tropical and Subtropical Moist Broadleaf Forest	Southwest Amazon moist forests	Photograph	1922	National Museum of Natural History USA
Melanistic 66	Iquitos, Maynas	-4,0606	-72,8442	Tropical and Subtropical Moist Broadleaf Forest	Southwest Amazon moist forests	Photograph	1926	American Museum of Natural History USA
Melanistic 67	Iquitos, Maynas	-3,8283	-72,4903	Tropical and Subtropical Moist Broadleaf Forest	Southwest Amazon moist forests	Photograph	1930	American Museum of Natural History USA
Melanistic 68	Iquitos, Maynas	-3,5756	-72,9091	Tropical and Subtropical Moist Broadleaf Forest	Southwest Amazon moist forests	Photograph	1930	American Museum of Natural History USA
Melanistic 69	Purus River, Brazil	-7,7928	-66,1362	Tropical and Subtropical Moist Broadleaf Forest	Purus varzeá	Photograph	2013	British Museum
Non-melanistic 01	Assis Brasil, Acre, Brazil	-10,9341	-69,5183	Tropical and Subtropical Moist Broadleaf Forest	Southwest Amazon moist forests	Faecal DNA	2007	Parque Ambiental Chico Mendes
Non-melanistic 02	Cruzeiro do Sul, Acre, Brazil	-7,6673	-72,6627	Tropical and Subtropical Moist Broadleaf Forest	Southwest Amazon moist forests	Faecal DNA	2007	Campinas Zoo
Non-melanistic 03	Feijó, Acre, Brazil	-8,2124	-70,3579	Tropical and Subtropical Moist Broadleaf Forest	Southwest Amazon moist forests	Faecal DNA	2007	Parque Ambiental Chico Mendes
Non-melanistic 04	Amanã, Amazonas, Brazil	-2,3309	-64,7553	Tropical and Subtropical Moist Broadleaf Forest	Japurá-Solimoes-Negro moist forests	Photograph	2012	Instituto Mamirauá Amazonas
Non-melanistic 05	Codafós, Amazonas, Brazil	-2,2092	-56,8277	Tropical and Subtropical Moist Broadleaf Forest	Uatuma-Trombetas moist forests	Capture	2008	CENAP ICMBio
Non-melanistic 06	Mamirauá, Amazonas, Brazil	-2,8384	-65,0010	Tropical and Subtropical Moist Broadleaf Forest	Purus varzeá	Photograph	2012	Instituto Mamirauá Amazonas
Non-melanistic 07	Manaus, Amazonas, Brazil	-3,0604	-59,8578	Tropical and Subtropical Moist Broadleaf Forest	Uatuma-Trombetas moist forests	Capture	1995	CENAP ICMBio
Non-melanistic 08	Manaus, Amazonas, Brazil	-2,8670	-59,5234	Tropical and Subtropical Moist Broadleaf Forest	Uatuma-Trombetas moist forests	Faecal DNA	2007	Curitiba Zoo
Non-melanistic 09	Manaus, Amazonas, Brazil	-2,7681	-59,3404	Tropical and Subtropical Moist Broadleaf Forest	Uatuma-Trombetas moist forests	Faecal DNA	2007	Curitiba Zoo
Non-melanistic 10	Manaus, Amazonas, Brazil	-3,2427	-59,8380	Tropical and Subtropical Moist Broadleaf Forest	Japurá-Solimoes-Negro moist forests	Faecal DNA	2007	Limeira Zoo
Non-melanistic 11	Manicoré, Amazonas, Brazil	-5,8259	-61,2851	Tropical and Subtropical Moist Broadleaf Forest	Madeira-Tapajós moist forests	Capture	2006	CENAP ICMBio
Non-melanistic 12	Miriti, Amazonas, Brazil	-6,6598	-62,3131	Tropical and Subtropical Moist Broadleaf Forest	Madeira-Tapajós moist forests	Report	1970	Panthera
Non-melanistic 13	Presidente Figueiredo, Amazonas, Brazil	-1,9847	-60,1656	Tropical and Subtropical Moist Broadleaf Forest	Uatuma-Trombetas moist forests	Capture	2006	CENAP ICMBio
Non-melanistic 14	Reserva Biologica Auatí-Paraná, Murinzal, Amazonas, Brazil	-2,0335	-66,2569	Tropical and Subtropical Moist Broadleaf Forest	Purus varzeá	Photograph	no data	Instituto Mamirauá Amazonas
Non-melanistic 15	Reserva Biológica do Uatumã, Amazonas, Brazil	-0,5880	-59,7264	Tropical and Subtropical Moist Broadleaf Forest	Uatuma-Trombetas moist forests	Photograph	no data	Jaguar Conservation Fund
Non-melanistic 16	Reserva de Desenvolvimento Sustentavel de Amanã, Amazonas, Brazil	-2,9482	-64,6556	Tropical and Subtropical Moist Broadleaf Forest	Purus varzeá	Photograph	2012	Instituto Mamirauá Amazonas
Non-melanistic 17	APA do Curiaú, Amapá, Brazil	0,1894	-51,0773	Tropical and Subtropical Moist Broadleaf Forest	Guianan savanna	Report	no data	MPB Amapá Brazil
Non-melanistic 18	Floresta Estadual do Amapá, Brazil	3,4596	-51,8600	Tropical and Subtropical Moist Broadleaf Forest	Guianan moist forests	Report	no data	MPB Amapá Brazil
Non-melanistic 19	Cabo Orange National Park, Amapá, Brazil	3,6518	-51,2203	Tropical and Subtropical Moist Broadleaf Forest	Marajó varzeá	Report	no data	MPB Amapá Brazil
Non-melanistic 20	Cabo Orange National Park, Amapá, Brazil	3,2428	-51,2468	Tropical and Subtropical Moist Broadleaf Forest	Uatuma-Trombetas moist forests	Photograph	2010	Kwata Association
Non-melanistic 21	Cabo Orange National Park, Amapá, Brazil	3,2428	-51,2468	Tropical and Subtropical Moist Broadleaf Forest	Uatuma-Trombetas moist forests	Photograph	2010	Kwata Association
Non-melanistic 22	Cabo Orange National Park, Amapá, Brazil	3,2428	-51,2468	Tropical and Subtropical Moist Broadleaf Forest	Uatuma-Trombetas moist forests	Photograph	2010	Kwata Association
Non-melanistic 23	Reserva Biologica Lago Piratuba, Amapá, Brazil	1,5712	-50,2094	Tropical and Subtropical Moist Broadleaf Forest	Marajó varzeá	Report	no data	MPB Amapá Brazil
Non-melanistic 24	Reserva Extrativista do Cajari, Amapá, Brazil	-0,6865	-51,9568	Tropical and Subtropical Moist Broadleaf Forest	Uatuma-Trombetas moist forests	Report	no data	MPB Amapá Brazil
Non-melanistic 25	Rio Araguari, Amapá, Brazil	0,8459	-51,3217	Tropical and Subtropical Moist Broadleaf Forest	Uatuma-Trombetas moist forests	Photograph	1940	Emilio Gueldi Museum
Non-melanistic 26	Caatinga da Bahia, Brazil	-9,7625	-40,7718	Desert and Xeric Shrublands	Caatinga	Photograph	no data	Morato et al 2007
Non-melanistic 27	Boqueirão da Onça National Park, Bahia, Brazil	-9,8466	-41,1734	Desert and Xeric Shrublands	Caatinga	Photograph	no data	CENAP ICMBio
Non-melanistic 28	Aruanã, Goiás, Brazil	-14,6955	-51,0066	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Report	2008	Jaguar Conservation Fund
Non-melanistic 29	Aruanã, Goiás, Brazil	-14,3310	-50,8188	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Photograph	no data	Jaguar Conservation Fund
Non-melanistic 30	Emas National Park, Goiás, Brazil	-17,9199	-52,8323	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Report	2002	Jaguar Conservation Fund
Non-melanistic 31	Emas National Park, Goiás, Brazil	-18,3353	-52,8256	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Report	2010	Jaguar Conservation Fund
Non-melanistic 32	Emas National Park, Goiás, Brazil	-18,2729	-52,9094	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Report	2010	Jaguar Conservation Fund
Non-melanistic 33	Emas National Park, Goiás, Brazil	-18,2034	-52,9816	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Report	2010	Jaguar Conservation Fund
Non-melanistic 34	Emas National Park, Goiás, Brazil	-18,0646	-52,9881	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Capture	2000	CENAP ICMBio
Non-melanistic 35	Emas National Park, Goiás, Brazil	-18,1666	-52,8184	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Photograph	2009	Jaguar Conservation Fund
Non-melanistic 36	Emas National Park, Goiás, Brazil	-18,1989	-53,0222	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Photograph	no data	Jaguar Conservation Fund
Non-melanistic 37	Emas National Park, Goiás, Brazil	-18,2267	-52,7877	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Photograph	no data	Jaguar Conservation Fund
Non-melanistic 38	Emas National Park, Goiás, Brazil	-18,2620	-52,8252	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Photograph	no data	Jaguar Conservation Fund
Non-melanistic 39	Emas National Park, Goiás, Brazil	-17,9077	-52,9595	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Photograph	no data	Jaguar Conservation Fund
Non-melanistic 40	Emas National Park, Goiás, Brazil	-17,8949	-52,8988	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Photograph	no data	Jaguar Conservation Fund
Non-melanistic 41	Emas National Park, Goiás, Brazil	-17,9632	-52,8569	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Photograph	no data	Jaguar Conservation Fund
Non-melanistic 42	Emas National Park, Goiás, Brazil	-17,9792	-52,8904	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Photograph	no data	Jaguar Conservation Fund
Non-melanistic 43	Emas National Park, Goiás, Brazil	-17,9994	-52,9197	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Photograph	no data	Jaguar Conservation Fund
Non-melanistic 44	Emas National Park, Goiás, Brazil	-18,2857	-52,9012	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Photograph	2008	Furtado et al 2008
Non-melanistic 45	Emas National Park, Goiás, Brazil	-18,3029	-52,7852	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Photograph	no data	Jaguar Conservation Fund
Non-melanistic 46	Emas National Park, Goiás, Brazil	-18,1296	-53,0660	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Photograph	no data	Jaguar Conservation Fund
Non-melanistic 47	Emas National Park, Goiás, Brazil	-17,9770	-52,9459	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Photograph	no data	Jaguar Conservation Fund
Non-melanistic 48	São Miguel do Araguaia, Goiás, Brazil	-13,2749	-50,3245	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Report	2010	Jaguar Conservation Fund

Samples	Locality / Country	Deg-WGS84		Biome	Ecoregion	Sample type	Year	Information Source
		Lat	Long					
Non-melanistic 49	São Miguel do Araguaia, Goiás, Brazil	-13,4297	-50,5468	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Report	2010	Jaguar Conservation Fund
Non-melanistic 50	São Miguel do Araguaia, Goiás, Brazil	-13,4220	-50,5518	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Report	2010	Jaguar Conservation Fund
Non-melanistic 51	Fazenda Lagoinha, Santa Luzia, Maranhão, Brazil	-3,9511	-45,8447	Tropical and Subtropical Moist Broadleaf Forest	Maranhão Babaçu forests	Photograph	1993	Emilio Gueldi Museum
Non-melanistic 52	Alto Rio Doce, Minas Gerais, Brazil	-21,0747	-43,4063	Tropical and Subtropical Moist Broadleaf Forest	Bahia interior forests	Photograph	2003	National Museum of Natural History USA
Non-melanistic 53	São Bento, Minas Gerais, Brazil	-21,7523	-45,2338	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Capture	2008	Instituto Pro-Carnívoros
Non-melanistic 54	São Bento, Minas Gerais, Brazil	-21,7521	-45,2606	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Capture	2008	Instituto Pro-Carnívoros
Non-melanistic 55	São Bento, Minas Gerais, Brazil	-21,7610	-45,2622	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Capture	2008	Instituto Pro-Carnívoros
Non-melanistic 56	Rio Doce State Park, Minas Gerais, Brazil	-19,7532	-42,5640	Tropical and Subtropical Moist Broadleaf Forest	Bahia interior forests	Photograph	2006	UFMG Brazil
Non-melanistic 57	Rio Doce State Park, Minas Gerais, Brazil	-19,7255	-42,5264	Tropical and Subtropical Moist Broadleaf Forest	Bahia interior forests	Photograph	2006	UFMG Brazil
Non-melanistic 58	Rio Doce State Park, Minas Gerais, Brazil	-19,6742	-42,5389	Tropical and Subtropical Moist Broadleaf Forest	Bahia interior forests	Photograph	2006	UFMG Brazil
Non-melanistic 59	Rio Doce State Park, Minas Gerais, Brazil	-19,6923	-42,5771	Tropical and Subtropical Moist Broadleaf Forest	Bahia interior forests	Photograph	2006	UFMG Brazil
Non-melanistic 60	Serra do Cabral State Park, Minas Gerais, Brazil	-17,5786	-44,2610	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Photograph	no data	Instituto Biotrópicos
Non-melanistic 61	Grande Sertão Veredas National Park, Minas Gerais, Brazil	-14,9408	-45,7548	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Report	2012	Instituto Biotrópicos
Non-melanistic 62	Grande Sertão Veredas National Park, Minas Gerais, Brazil	-15,1683	-45,7128	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Photograph	2011	Instituto Biotrópicos
Non-melanistic 63	Grande Sertão Veredas National Park, Minas Gerais, Brazil	-14,9403	-45,8065	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Report	2010	Instituto Biotrópicos
Non-melanistic 64	Grande Sertão Veredas National Park, Minas Gerais, Brazil	-14,9409	-45,7550	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Photograph	2011	Instituto Biotrópicos
Non-melanistic 65	Grande Sertão Veredas National Park, Minas Gerais, Brazil	-15,2611	-45,7538	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Report	2010	Instituto Biotrópicos
Non-melanistic 66	Grande Sertão Veredas National Park, Minas Gerais, Brazil	-15,3132	-45,7682	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Photograph	2010	Instituto Biotrópicos
Non-melanistic 67	Veredas do Peruaçu National Park, Minas Gerais, Brazil	-14,9593	-44,6702	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Photograph	2010	Instituto Biotrópicos
Non-melanistic 68	Pouso Alegre, Minas Gerais, Brazil	-22,1437	-45,8317	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Photograph	2006	CENAP ICMBio
Non-melanistic 69	Rio Doce State Park Boundaries, Minas Gerais, Brazil	-19,6573	-42,6213	Tropical and Subtropical Moist Broadleaf Forest	Bahia interior forests	Photograph	1981	UFMG Brazil
Non-melanistic 70	Anaurilândia, Mato Grosso do Sul, Brazil	-21,8027	-52,9789	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Faecal DNA	1999	Instituto de Pesquisas Ecológicas
Non-melanistic 71	Aquidauana, Mato Grosso do Sul, Brazil	-20,2908	-55,6278	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Photograph	2008	Silveira et al 2008
Non-melanistic 72	Aquidauana, Mato Grosso do Sul, Brazil	-20,2908	-55,6278	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Photograph	2008	Silveira et al 2008
Non-melanistic 73	Aquidauana, Mato Grosso do Sul, Brazil	-20,2908	-55,6278	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Photograph	2008	Furtado & Filoni 2008
Non-melanistic 74	Bodoquena, Mato Grosso do Sul, Brazil	-20,1012	-56,7932	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Photograph	1960	MUZUSP Brazil
Non-melanistic 75	Morro do Azeite, Corumbá, Mato Grosso do Sul, Brazil	-19,1738	-57,5491	Tropical and Subtropical Dry Broadleaf Forest	Chiquitano dry forests	Capture	2006	Polícia Ambiental MS
Non-melanistic 76	Campo Grande, Mato Grosso do Sul, Brazil	-20,5763	-54,7572	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Faecal DNA	no data	Pomerode Zoo
Non-melanistic 77	Campo Grande, Mato Grosso do Sul, Brazil	-20,4265	-54,7168	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Faecal DNA	no data	Pomerode Zoo
Non-melanistic 78	Campo Grande, Mato Grosso do Sul, Brazil	-20,3481	-54,5438	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Faecal DNA	no data	Pomerode Zoo
Non-melanistic 79	Corumbá, Mato Grosso do Sul, Brazil	-19,0660	-57,7207	Tropical and Subtropical Dry Broadleaf Forest	Chiquitano dry forests	Photograph	1992	CENAP ICMBio
Non-melanistic 80	Corumbá, Mato Grosso do Sul, Brazil	-18,9969	-57,6621	Tropical and Subtropical Dry Broadleaf Forest	Chiquitano dry forests	Capture	2006	Embrapa Brazil
Non-melanistic 81	Corumbá, Mato Grosso do Sul, Brazil	-18,9969	-57,6621	Tropical and Subtropical Dry Broadleaf Forest	Chiquitano dry forests	Capture	2006	Embrapa Brazil
Non-melanistic 82	Corumbá, Mato Grosso do Sul, Brazil	-18,5881	-57,5362	Tropical and Subtropical Dry Broadleaf Forest	Chiquitano dry forests	Photograph	2006	Embrapa Brazil
Non-melanistic 83	Corumbá, Mato Grosso do Sul, Brazil	-18,5881	-57,5362	Tropical and Subtropical Dry Broadleaf Forest	Chiquitano dry forests	Photograph	2006	Embrapa Brazil
Non-melanistic 84	Corumbá, Mato Grosso do Sul, Brazil	-18,9969	-57,6364	Tropical and Subtropical Dry Broadleaf Forest	Chiquitano dry forests	Capture	2006	Embrapa Brazil
Non-melanistic 85	Fazenda Ariranha, Porto Primavera, Mato Grosso do Sul, Brazil	-21,9882	-52,3934	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Capture	1993	Eizirik et al 2003
Non-melanistic 86	Fazenda Barranco Alto, Pantanal do Rio Negro, Mato Grosso do Sul, Brazil	-19,5356	-56,1354	Flooded Grasslands and Savannas	Pantanal	Photograph	2008	Jaguar Conservation Fund
Non-melanistic 87	Fazenda Caiman, Miranda, Mato Grosso do Sul, Brazil	-19,9124	-56,3909	Flooded Grasslands and Savannas	Pantanal	Photograph	2012	CENAP ICMBio
Non-melanistic 88	Fazenda Casa de Pedra, Anaurilândia, Mato Grosso do Sul, Brazil	-21,8929	-52,6613	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Faecal DNA	2004	Instituto Pro-Carnívoros
Non-melanistic 89	Fazenda Casa de Pedra, Anaurilândia, Mato Grosso do Sul, Brazil	-21,8662	-52,6099	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Faecal DNA	2004	Instituto Pro-Carnívoros
Non-melanistic 90	Fazenda Morro das Pedras, Nhacolandia, Mato Grosso do Sul, Brazil	-19,3083	-55,7628	Flooded Grasslands and Savannas	Pantanal	Photograph	2011	Instituto de Pesquisas Ecológicas
Non-melanistic 91	Fazenda San Francisco, Mato Grosso do Sul, Brazil	-18,6641	-56,3946	Flooded Grasslands and Savannas	Pantanal	Foto	2012	CENAP ICMBio
Non-melanistic 92	Fazenda San Francisco, Mato Grosso do Sul, Brazil	-18,6641	-56,3946	Flooded Grasslands and Savannas	Pantanal	Foto	no data	CENAP ICMBio
Non-melanistic 93	Fazenda San Francisco, Mato Grosso do Sul, Brazil	-18,6598	-56,4543	Flooded Grasslands and Savannas	Pantanal	Foto	no data	CENAP ICMBio
Non-melanistic 94	Fazenda São Bento, Mato Grosso do Sul, Brazil	-18,8578	-57,3220	Flooded Grasslands and Savannas	Pantanal	Foto	no data	UFRGS Brazil
Non-melanistic 95	Fazenda São Bento, Mato Grosso do Sul, Brazil	-18,8888	-57,3210	Flooded Grasslands and Savannas	Pantanal	Foto	no data	UFRGS Brazil
Non-melanistic 96	Fazenda São Bento, Mato Grosso do Sul, Brazil	-19,5011	-57,0078	Flooded Grasslands and Savannas	Pantanal	Capture	1995	Instituto Pro-Carnívoros
Non-melanistic 97	Fazenda São Bento, Mato Grosso do Sul, Brazil	-19,4989	-57,0665	Flooded Grasslands and Savannas	Pantanal	Capture	2008	Instituto Pro-Carnívoros
Non-melanistic 98	Fazenda São Bento, Mato Grosso do Sul, Brazil	-19,4989	-57,0665	Flooded Grasslands and Savannas	Pantanal	Capture	2008	Instituto Pro-Carnívoros
Non-melanistic 99	Fazenda São Bento, Mato Grosso do Sul, Brazil	-19,4956	-57,0547	Flooded Grasslands and Savannas	Pantanal	Capture	2008	Instituto Pro-Carnívoros
Non-melanistic 100	Fazenda São Bento, Mato Grosso do Sul, Brazil	-19,5890	-56,9934	Flooded Grasslands and Savannas	Pantanal	Capture	2008	Instituto Pro-Carnívoros
Non-melanistic 101	Fazenda São Bento, Mato Grosso do Sul, Brazil	-19,4583	-56,8893	Flooded Grasslands and Savannas	Pantanal	Capture	2008	Instituto Pro-Carnívoros
Non-melanistic 102	Fazenda São Bento, Mato Grosso do Sul, Brazil	-19,4300	-56,9080	Flooded Grasslands and Savannas	Pantanal	Capture	2008	Instituto Pro-Carnívoros
Non-melanistic 103	Fazenda São Bento, Mato Grosso do Sul, Brazil	-19,4773	-56,8310	Flooded Grasslands and Savannas	Pantanal	Capture	2008	Instituto Pro-Carnívoros
Non-melanistic 104	Fazenda São Bento, Mato Grosso do Sul, Brazil	-19,5320	-56,9246	Flooded Grasslands and Savannas	Pantanal	Capture	2008	Instituto Pro-Carnívoros
Non-melanistic 105	Fazenda São Bento, Mato Grosso do Sul, Brazil	-19,6153	-56,9246	Flooded Grasslands and Savannas	Pantanal	Photograph	2012	CENAP ICMBio
Non-melanistic 106	Fazenda São Bento, Mato Grosso do Sul, Brazil	-19,6488	-56,8898	Flooded Grasslands and Savannas	Pantanal	Photograph	2012	CENAP ICMBio
Non-melanistic 107	Fazenda São Bento, Mato Grosso do Sul, Brazil	-19,4475	-56,8890	Flooded Grasslands and Savannas	Pantanal	Capture	2008	Instituto Pro-Carnívoros
Non-melanistic 108	Fazenda Sete, Aquidauana, Mato Grosso do Sul, Brazil	-19,9038	-55,7686	Flooded Grasslands and Savannas	Pantanal	Capture	2001	CENAP ICMBio

Samples	Locality / Country	Deg-WGS84		Biome	Ecoregion	Sample type	Year	Information Source
		Lat	Long					
Non-melanistic 109	Fazenda Sete, Aquidauana, Mato Grosso do Sul, Brazil	-19,9419	-55,7258	Flooded Grasslands and Savannas	Pantanal	Capture	2001	CENAP ICMBio
Non-melanistic 110	Fazenda Sete, Aquidauana, Mato Grosso do Sul, Brazil	-20,0000	-55,7042	Flooded Grasslands and Savannas	Pantanal	Capture	2001	CENAP ICMBio
Non-melanistic 111	Fazenda Sete, Aquidauana, Mato Grosso do Sul, Brazil	-20,0000	-55,7410	Flooded Grasslands and Savannas	Pantanal	Capture	2002	CENAP ICMBio
Non-melanistic 112	Fazenda Sete, Aquidauana, Mato Grosso do Sul, Brazil	-19,9576	-55,7701	Flooded Grasslands and Savannas	Pantanal	Capture	2003	CENAP ICMBio
Non-melanistic 113	Fazenda Sete, Aquidauana, Mato Grosso do Sul, Brazil	-20,0383	-55,7792	Flooded Grasslands and Savannas	Pantanal	Capture	2003	CENAP ICMBio
Non-melanistic 114	Fazenda Sete, Aquidauana, Mato Grosso do Sul, Brazil	-20,0000	-55,8026	Flooded Grasslands and Savannas	Pantanal	Capture	2003	CENAP ICMBio
Non-melanistic 115	Fazenda Sete, Aquidauana, Mato Grosso do Sul, Brazil	-20,1135	-55,8232	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Capture	2003	CENAP ICMBio
Non-melanistic 116	Fazenda Sete, Aquidauana, Mato Grosso do Sul, Brazil	-20,0804	-55,7595	Flooded Grasslands and Savannas	Pantanal	Capture	2003	CENAP ICMBio
Non-melanistic 117	Fazenda Sete, Aquidauana, Mato Grosso do Sul, Brazil	-20,0000	-55,8432	Flooded Grasslands and Savannas	Pantanal	Capture	2003	CENAP ICMBio
Non-melanistic 118	Fazenda Sete, Aquidauana, Mato Grosso do Sul, Brazil	-19,9563	-55,8591	Flooded Grasslands and Savannas	Pantanal	Capture	2001	CENAP ICMBio
Non-melanistic 119	Ilha do Jazao, Mato Grosso do Sul, Brazil	-22,1799	-52,6166	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Capture	1993	Eizirik et al 2003
Non-melanistic 120	Ivinhema, Mato Grosso do Sul, Brazil	-22,8592	-53,6333	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Capture	2004	Instituto Pro-Carnívoros
Non-melanistic 121	Ivinhema, Mato Grosso do Sul, Brazil	-22,0322	-53,7647	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Capture	2004	Instituto Pro-Carnívoros
Non-melanistic 122	Ivinhema, Mato Grosso do Sul, Brazil	-22,7909	-53,6723	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Capture	2005	Instituto Pro-Carnívoros
Non-melanistic 123	Ivinhema, Mato Grosso do Sul, Brazil	-22,7909	-53,6723	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Capture	2005	Instituto Pro-Carnívoros
Non-melanistic 124	Ivinhema, Mato Grosso do Sul, Brazil	-22,9376	-53,6858	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Faecal DNA	2005	Instituto Pro-Carnívoros
Non-melanistic 125	Ivinhema, Mato Grosso do Sul, Brazil	-22,8787	-53,6558	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Capture	2002	Instituto Pro-Carnívoros
Non-melanistic 126	Ivinhema, Mato Grosso do Sul, Brazil	-22,7739	-53,6666	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Capture	2006	Instituto Pro-Carnívoros
Non-melanistic 127	Ivinhema, Mato Grosso do Sul, Brazil	-22,7863	-53,6673	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Faecal DNA	2005	Instituto Pro-Carnívoros
Non-melanistic 128	Miranda, Mato Grosso do Sul, Brazil	-20,2077	-56,4771	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Photograph	2012	ULBRA Brazil
Non-melanistic 129	Miranda, Mato Grosso do Sul, Brazil	-20,0835	-56,6001	Flooded Grasslands and Savannas	Pantanal	Capture	2003	Instituto Pro-Carnívoros
Non-melanistic 130	Miranda, Mato Grosso do Sul, Brazil	-20,0835	-56,6001	Flooded Grasslands and Savannas	Pantanal	Capture	2003	Instituto Pro-Carnívoros
Non-melanistic 131	Miranda, Mato Grosso do Sul, Brazil	-20,0835	-56,6001	Flooded Grasslands and Savannas	Pantanal	Capture	2003	Instituto Pro-Carnívoros
Non-melanistic 132	Miranda, Mato Grosso do Sul, Brazil	-20,0835	-56,6001	Flooded Grasslands and Savannas	Pantanal	Capture	2003	Instituto Pro-Carnívoros
Non-melanistic 133	Miranda, Mato Grosso do Sul, Brazil	-20,0835	-56,6001	Flooded Grasslands and Savannas	Pantanal	Capture	2003	Instituto Pro-Carnívoros
Non-melanistic 134	Miranda, Mato Grosso do Sul, Brazil	-20,0835	-56,6001	Flooded Grasslands and Savannas	Pantanal	Capture	2003	Instituto Pro-Carnívoros
Non-melanistic 135	Miranda, Mato Grosso do Sul, Brazil	-20,0835	-56,6001	Flooded Grasslands and Savannas	Pantanal	Capture	2003	Instituto Pro-Carnívoros
Non-melanistic 136	Miranda, Mato Grosso do Sul, Brazil	-20,0835	-56,6001	Flooded Grasslands and Savannas	Pantanal	Capture	2003	Instituto Pro-Carnívoros
Non-melanistic 137	Miranda, Mato Grosso do Sul, Brazil	-20,0835	-56,6001	Flooded Grasslands and Savannas	Pantanal	Capture	2004	Instituto Pro-Carnívoros
Non-melanistic 138	Miranda, Mato Grosso do Sul, Brazil	-20,0835	-56,6001	Flooded Grasslands and Savannas	Pantanal	Capture	2004	Instituto Pro-Carnívoros
Non-melanistic 139	Miranda, Mato Grosso do Sul, Brazil	-20,0835	-56,6001	Flooded Grasslands and Savannas	Pantanal	Capture	2004	Instituto Pro-Carnívoros
Non-melanistic 140	Pantanal de Miranda, Mato Grosso do Sul, Brazil	-19,5757	-56,2287	Flooded Grasslands and Savannas	Pantanal	Report	2002	Jaguar Conservation Fund
Non-melanistic 141	Pantanal de Miranda, Mato Grosso do Sul, Brazil	-19,9261	-56,3049	Flooded Grasslands and Savannas	Pantanal	Report	2003	Jaguar Conservation Fund
Non-melanistic 142	Pantanal de Miranda, Mato Grosso do Sul, Brazil	-19,6950	-56,3311	Flooded Grasslands and Savannas	Pantanal	Photograph	2004	Jaguar Conservation Fund
Non-melanistic 143	Pantanal de Miranda, Mato Grosso do Sul, Brazil	-19,7488	-56,3610	Flooded Grasslands and Savannas	Pantanal	Report	2003	Jaguar Conservation Fund
Non-melanistic 144	Porto Murtinho, Mato Grosso do Sul, Brazil	-21,7168	-57,8560	Tropical and Subtropical Grasslands, Savannas and Shrublands	Humid Chaco	Photograph	2011	Polícia Federal Brazil
Non-melanistic 145	Porto Primavera, Anaurilândia, Mato Grosso do Sul, Brazil	-22,2420	-52,7541	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Capture	1999	Instituto Pro-Carnívoros
Non-melanistic 146	Porto Primavera, Anaurilândia, Mato Grosso do Sul, Brazil	-22,1133	-52,6430	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Capture	1998	CENAP ICMBio
Non-melanistic 147	Porto Primavera, Anaurilândia, Mato Grosso do Sul, Brazil	-22,0697	-52,4144	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Capture	1998	CENAP ICMBio
Non-melanistic 148	Porto Primavera, Anaurilândia, Mato Grosso do Sul, Brazil	-22,0942	-52,4167	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Capture	1998	CENAP ICMBio
Non-melanistic 149	Porto Primavera, Anaurilândia, Mato Grosso do Sul, Brazil	-22,1147	-53,0229	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Capture	1998	CENAP ICMBio
Non-melanistic 150	Porto Primavera, Anaurilândia, Mato Grosso do Sul, Brazil	-21,8342	-52,4048	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Capture	2000	Ilha Solteira Zoo
Non-melanistic 151	Porto Primavera, Anaurilândia, Mato Grosso do Sul, Brazil	-22,0949	-52,8826	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Capture	1999	CENAP ICMBio
Non-melanistic 152	Porto Primavera, Anaurilândia, Mato Grosso do Sul, Brazil	-22,1701	-52,6398	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Capture	2000	CENAP ICMBio
Non-melanistic 153	Porto Primavera, Anaurilândia, Mato Grosso do Sul, Brazil	-22,1216	-52,5255	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Capture	2000	Rio de Janeiro Zoo
Non-melanistic 154	Porto Primavera, Anaurilândia, Mato Grosso do Sul, Brazil	-21,8342	-52,4048	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Capture	2000	Ilha Solteira Zoo
Non-melanistic 155	Porto Primavera, Bataguassu, Mato Grosso do Sul, Brazil	-21,9635	-52,4821	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Capture	1999	Eizirik et al 2003
Non-melanistic 156	Porto Primavera, Bataguassu, Mato Grosso do Sul, Brazil	-21,5915	-52,2312	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Capture	1993	Eizirik et al 2003
Non-melanistic 157	Porto Primavera, Fazenda Ariranha, Mato Grosso do Sul, Brazil	-22,1131	-52,6430	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Capture	1998	CENAP ICMBio
Non-melanistic 158	Refugio Ecologico Fazenda Caiman, Mato Grosso do Sul, Brazil	-20,1078	-56,3628	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Capture	2006	Jaguar Conservation Fund
Non-melanistic 159	Refugio Ecologico Fazenda Caiman, Mato Grosso do Sul, Brazil	-20,1056	-56,3841	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Capture	2003	Jaguar Conservation Fund
Non-melanistic 160	Refugio Ecologico Fazenda Caiman, Mato Grosso do Sul, Brazil	-20,0855	-56,3931	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Capture	2003	Jaguar Conservation Fund
Non-melanistic 161	Refugio Ecologico Fazenda Caiman, Mato Grosso do Sul, Brazil	-20,0452	-56,3720	Flooded Grasslands and Savannas	Pantanal	Capture	2003	Jaguar Conservation Fund
Non-melanistic 162	Refugio Ecologico Fazenda Caiman, Mato Grosso do Sul, Brazil	-20,0597	-56,3451	Flooded Grasslands and Savannas	Pantanal	Capture	2003	Jaguar Conservation Fund
Non-melanistic 163	Refugio Ecologico Fazenda Caiman, Mato Grosso do Sul, Brazil	-20,0852	-56,3036	Flooded Grasslands and Savannas	Pantanal	Capture	2005	Jaguar Conservation Fund
Non-melanistic 164	Refugio Ecologico Fazenda Caiman, Mato Grosso do Sul, Brazil	-20,1163	-56,3015	Flooded Grasslands and Savannas	Pantanal	Capture	2005	Jaguar Conservation Fund
Non-melanistic 165	Refugio Ecologico Fazenda Caiman, Mato Grosso do Sul, Brazil	-20,1187	-56,2990	Flooded Grasslands and Savannas	Pantanal	Capture	2005	Jaguar Conservation Fund
Non-melanistic 166	Refugio Ecologico Fazenda Caiman, Mato Grosso do Sul, Brazil	-20,1300	-56,3291	Flooded Grasslands and Savannas	Pantanal	Capture	2006	Jaguar Conservation Fund
Non-melanistic 167	Refugio Ecologico Fazenda Caiman, Mato Grosso do Sul, Brazil	-20,1422	-56,3034	Flooded Grasslands and Savannas	Pantanal	Capture	2006	Jaguar Conservation Fund
Non-melanistic 168	Refugio Ecologico Fazenda Caiman, Mato Grosso do Sul, Brazil	-20,0487	-56,3977	Flooded Grasslands and Savannas	Pantanal	Capture	2006	Jaguar Conservation Fund

Samples	Locality / Country	Deg-WGS84		Biome	Ecoregion	Sample type	Year	Information Source
		Lat	Long					
Non-melanistic 169	Refugio Ecologico Fazenda Caiman, Mato Grosso do Sul, Brazil	-20,0341	-56,3877	Flooded Grasslands and Savannas	Pantanal	Capture	2006	Jaguar Conservation Fund
Non-melanistic 170	Refugio Ecologico Fazenda Caiman, Mato Grosso do Sul, Brazil	-20,0251	-56,3721	Flooded Grasslands and Savannas	Pantanal	Capture	2006	Jaguar Conservation Fund
Non-melanistic 171	Refugio Ecologico Fazenda Caiman, Mato Grosso do Sul, Brazil	-19,9690	-56,3641	Flooded Grasslands and Savannas	Pantanal	Photograph	2011	CENAP ICMBio
Non-melanistic 172	Refugio Ecologico Fazenda Caiman, Mato Grosso do Sul, Brazil	-19,9829	-56,4025	Flooded Grasslands and Savannas	Pantanal	Photograph	2011	CENAP ICMBio
Non-melanistic 173	Rio Miranda, Mato Grosso do Sul, Brazil	-19,4474	-57,2993	Flooded Grasslands and Savannas	Pantanal	Photograph	2011	CENAP ICMBio
Non-melanistic 174	Ronda do Laucides, Bataguassu, Mato Grosso do Sul, Brazil	-21,9862	-52,3771	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Capture	1993	Jaguar Conservation Fund
Non-melanistic 175	São Carlos, Anaurilândia, Mato Grosso do Sul, Brazil	-22,1303	-52,5676	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Capture	2002	Jaguar Conservation Fund
Non-melanistic 176	Taquari, Mato Grosso do Sul, Brazil	-18,3167	-56,9834	Flooded Grasslands and Savannas	Pantanal	Capture	2002	Jaguar Conservation Fund
Non-melanistic 177	Taquarussu, Ivinhema, Mato Grosso do Sul, Brazil	-22,7269	-53,5238	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Capture	2007	IBAMA
Non-melanistic 178	Alta Floresta, Mato Grosso, Brazil	-10,3312	-56,4251	Tropical and Subtropical Moist Broadleaf Forest	Mato Grosso seasonal forests	Capture	2003	UNIFAP Brazil
Non-melanistic 179	Alta Floresta, Mato Grosso, Brazil	-9,9999	-56,7304	Tropical and Subtropical Moist Broadleaf Forest	Madeira-Tapajós moist forests	Capture	no data	UNIFAP Brazil
Non-melanistic 180	Alta Floresta, Mato Grosso, Brazil	-9,5484	-55,8740	Tropical and Subtropical Moist Broadleaf Forest	Mato Grosso seasonal forests	Photograph	no data	UNIFAP Brazil
Non-melanistic 181	Alta Floresta, Mato Grosso, Brazil	-9,7351	-56,1632	Tropical and Subtropical Moist Broadleaf Forest	Madeira-Tapajós moist forests	Photograph	no data	UNIFAP Brazil
Non-melanistic 182	Berrante Rio das Mortes, Ribeirão Cascalheira, , Mato Grosso, Brazil	-12,7999	-57,0329	Tropical and Subtropical Moist Broadleaf Forest	Mato Grosso seasonal forests	Capture	2006	CENAP ICMBio
Non-melanistic 183	Cáceres, Mato Grosso, Brazil	-16,0262	-57,2407	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Photograph	no data	UNIFAP Brazil
Non-melanistic 184	Ponte do Rio Arinos, Diamantino, Mato Grosso, Brazil	-14,3001	-56,1420	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Photograph	2009	UNIFAP Brazil
Non-melanistic 185	Estação Ecológica do Taiamã, Mato Grosso, Brazil	-16,9694	-56,2463	Flooded Grasslands and Savannas	Pantanal	Photograph	2012	CENAP ICMBio
Non-melanistic 186	Estação Ecológica do Taiamã, Mato Grosso, Brazil	-16,8936	-56,3717	Flooded Grasslands and Savannas	Pantanal	Report	2012	CENAP ICMBio
Non-melanistic 187	Estação Ecológica do Taiamã, Mato Grosso, Brazil	-16,7469	-57,7308	Flooded Grasslands and Savannas	Pantanal	Photograph	2011	CENAP ICMBio
Non-melanistic 188	Estação Ecológica do Taiamã, Mato Grosso, Brazil	-16,7569	-57,6564	Flooded Grasslands and Savannas	Pantanal	Photograph	2011	CENAP ICMBio
Non-melanistic 189	Fazenda Barranco Alto, Mato Grosso do Sul, Brazil	-19,5722	-56,1616	Flooded Grasslands and Savannas	Pantanal	Capture	2007	Jaguar Conservation Fund
Non-melanistic 190	Fazenda Miranda, Mato Grosso do Sul, Brazil	-19,8259	-56,3364	Flooded Grasslands and Savannas	Pantanal	Capture	2007	Jaguar Conservation Fund
Non-melanistic 191	Fazenda Miranda, Mato Grosso do Sul, Brazil	-19,9542	-56,2526	Flooded Grasslands and Savannas	Pantanal	Capture	2006	Jaguar Conservation Fund
Non-melanistic 192	Fazenda Miranda, Mato Grosso do Sul, Brazil	-19,7580	-56,3293	Flooded Grasslands and Savannas	Pantanal	Capture	2007	Jaguar Conservation Fund
Non-melanistic 193	Fazenda Miranda, Mato Grosso do Sul, Brazil	-19,7580	-56,3293	Flooded Grasslands and Savannas	Pantanal	Capture	2007	Jaguar Conservation Fund
Non-melanistic 194	Fazenda Miranda, Mato Grosso do Sul, Brazil	-19,9453	-56,2370	Flooded Grasslands and Savannas	Pantanal	Capture	2008	Jaguar Conservation Fund
Non-melanistic 195	Fazenda Miranda, Mato Grosso do Sul, Brazil	-19,8532	-56,3178	Flooded Grasslands and Savannas	Pantanal	Capture	2007	Jaguar Conservation Fund
Non-melanistic 196	Fazenda Miranda, Mato Grosso do Sul, Brazil	-19,9394	-56,2690	Flooded Grasslands and Savannas	Pantanal	Capture	2006	Jaguar Conservation Fund
Non-melanistic 197	Fazenda Miranda, Mato Grosso do Sul, Brazil	-19,9696	-56,2440	Flooded Grasslands and Savannas	Pantanal	Capture	2007	Jaguar Conservation Fund
Non-melanisti 198	Lambari D'Oeste, Mato Grosso, Brazil	-15,3243	-58,0045	Tropical and Subtropical Dry Broadleaf Forest	Chiquitano dry forests	Capture	2005	Jaguar Conservation Fund
Non-melanistic 199	Lucas do Rio Verde, Mato Grosso, Brazil	-13,0278	-55,8976	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Photograph	no data	IBAMA
Non-melanistic 200	Santa Rosa, Mato Grosso, Brazil	-8,8195	-57,5502	Tropical and Subtropical Moist Broadleaf Forest	Mato Grosso seasonal forests	Photograph	1934	Emilio Gueldi Museum
Non-melanistic 201	Comodoro, Mato Grosso, Brazil	-13,7100	-59,7852	Tropical and Subtropical Dry Broadleaf Forest	Chiquitano dry forests	Photograph	2003	National Museum of Natural History USA
Non-melanistic 202	Pantanal Matogrossense National Park, Mato Grosso, Brazil	-16,5988	-57,7876	Flooded Grasslands and Savannas	Pantanal	Photograph	no data	CENAP ICMBio
Non-melanistic 203	Pantanal Matogrossense National Park, Mato Grosso, Brazil	-17,8486	-57,5106	Tropical and Subtropical Dry Broadleaf Forest	Chiquitano dry forests	Photograph	no data	CENAP ICMBio
Non-melanistic 204	Pantanal Matogrossense National Park, Mato Grosso, Brazil	-17,6112	-57,6217	Tropical and Subtropical Dry Broadleaf Forest	Chiquitano dry forests	Photograph	2008	Astete et al 2008
Non-melanistic 205	Pantanal Matogrossense National Park, Mato Grosso, Brazil	-17,6692	-57,4298	Tropical and Subtropical Dry Broadleaf Forest	Chiquitano dry forests	Photograph	2009	Hunter & Rabinowitz 2009
Non-melanistic 206	Chapada dos Guimarães National Park, Mato Grosso, Brazil	-15,2962	-55,8451	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Photograph	no data	CENAP ICMBio
Non-melanistic 207	Pantanal Matogrossense National Park, Mato Grosso, Brazil	-17,8244	-57,4367	Tropical and Subtropical Dry Broadleaf Forest	Chiquitano dry forests	Photograph	1941	MUZUSP Brazil
Non-melanistic 208	Cuiabá River, Pantanal, Mato Grosso, Brazil	-16,3590	-55,9603	Flooded Grasslands and Savannas	Pantanal	Photograph	2010	CENAP ICMBio
Non-melanistic 209	Rondonópolis, Mato Grosso, Brazil	-16,4351	-54,5661	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Photograph	2010	CENAP ICMBio
Non-melanistic 210	RPPN Acurizal, Mato Grosso, Brazil	-14,1839	-60,1351	Tropical and Subtropical Dry Broadleaf Forest	Chiquitano dry forests	Photograph	no data	Ecotrópica
Non-melanistic 211	RPPN Acurizal, Mato Grosso, Brazil	-14,2708	-60,1649	Tropical and Subtropical Dry Broadleaf Forest	Chiquitano dry forests	Photograph	no data	Ecotrópica
Non-melanistic 212	Belém, Pará, Brazil	-1,7662	-48,3392	Tropical and Subtropical Moist Broadleaf Forest	Tocantins/Pindare moist forests	Photograph	1982	Emilio Gueldi Museum
Non-melanistic 213	Belém, Pará, Brazil	-1,7240	-48,4809	Tropical and Subtropical Moist Broadleaf Forest	Tocantins/Pindare moist forests	Photograph	1987	Emilio Gueldi Museum
Non-melanistic 214	Belém, Pará, Brazil	-1,5466	-48,2090	Tropical and Subtropical Moist Broadleaf Forest	Tocantins/Pindare moist forests	Photograph	1940	Emilio Gueldi Museum
Non-melanistic 215	Belém, Pará, Brazil	-1,5175	-48,3405	Tropical and Subtropical Moist Broadleaf Forest	Tocantins/Pindare moist forests	Photograph	1944	Emilio Gueldi Museum
Non-melanistic 216	Pacajá, Pará, Brazil	-4,2750	-50,6824	Tropical and Subtropical Moist Broadleaf Forest	Xingu-Tocantins-Araguaia moist forests	Photograph	no data	IBAMA
Non-melanistic 217	Amazonia National Park, Pará, Brazil	-4,4155	-56,6850	Tropical and Subtropical Moist Broadleaf Forest	Madeira-Tapajós moist forests	Photograph	2009	CENAP ICMBio
Non-melanistic 218	Cantão National Park, Pará, Brazil	-9,6083	-50,1622	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Report	2006	Jaguar Conservation Fund
Non-melanistic 219	Cantão National Park, Pará, Brazil	-9,6896	-50,1744	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Report	2005	Jaguar Conservation Fund
Non-melanistic 220	Cantão National Park, Pará, Brazil	-9,5939	-50,2045	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Report	2007	Jaguar Conservation Fund
Non-melanistic 221	Rondon do Pará, Brazil	-4,7354	-48,1090	Tropical and Subtropical Moist Broadleaf Forest	Tocantins/Pindare moist forests	Capture	2008	Policia Ambiental Pará Brazil
Non-melanistic 222	Rondon do Pará, Brazil	-4,7263	-48,2638	Tropical and Subtropical Moist Broadleaf Forest	Tocantins/Pindare moist forests	Capture	2008	Policia Ambiental Pará Brazil
Non-melanistic 223	Taperinha, Pará, Brazil	-2,5721	-48,2812	Tropical and Subtropical Moist Broadleaf Forest	Tocantins/Pindare moist forests	Photograph	1920	MUZUSP Brazil
Non-melanistic 224	Tucuruí, Pará, Brazil	-3,7356	-49,7390	Tropical and Subtropical Moist Broadleaf Forest	Xingu-Tocantins-Araguaia moist forests	Capture	2008	Fundação Zoobotânica Pará Brazil
Non-melanistic 225	Vila Bravo, Tocantins River, Pará, Brazil	-4,6099	-47,9468	Tropical and Subtropical Moist Broadleaf Forest	Tocantins/Pindare moist forests	Photograph	1980	MUZUSP Brazil
Non-melanistic 226	Nascente do Parnaíba, Piauí, Brazil	-10,0948	-45,7178	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Report	2008	Jaguar Conservation Fund
Non-melanistic 227	Serra da Capivara National Park, Piauí, Brazil	-8,7106	-42,5164	Desert and Xeric Shrublands	Caatinga	Report	2010	Jaguar Conservation Fund
Non-melanistic 228	Serra da Capivara National Park, Piauí, Brazil	-8,6001	-42,5694	Desert and Xeric Shrublands	Caatinga	Report	2010	Jaguar Conservation Fund

Samples	Locality / Country	Deg-WGS84		Biome	Ecoregion	Sample type	Year	Information Source
		Lat	Long					
Non-melanistic 229	Serra da Capivara National Park, Piauí, Brazil	-8,7206	-42,4889	Desert and Xeric Shrublands	Caatinga	Photograph	2010	Jaguar Conservation Fund
Non-melanistic 230	Serra da Capivara National Park, Piauí, Brazil	-8,6558	-42,5931	Desert and Xeric Shrublands	Caatinga	Photograph	2009	Jaguar Conservation Fund
Non-melanistic 231	Serra da Capivara National Park, Piauí, Brazil	-8,6890	-42,5551	Desert and Xeric Shrublands	Caatinga	Photograph	2010	Jaguar Conservation Fund
Non-melanistic 232	Serra da Capivara National Park, Piauí, Brazil	-8,6497	-42,5266	Desert and Xeric Shrublands	Caatinga	Photograph	2010	Jaguar Conservation Fund
Non-melanistic 233	Serra da Capivara National Park, Piauí, Brazil	-8,8096	-42,5945	Desert and Xeric Shrublands	Caatinga	Photograph	2007	UNB Brazil
Non-melanistic 234	Serra da Capivara National Park, Piauí, Brazil	-8,7234	-42,4645	Desert and Xeric Shrublands	Caatinga	Photograph	2007	UNB Brazil
Non-melanistic 235	Serra da Capivara National Park, Piauí, Brazil	-8,7660	-42,5926	Desert and Xeric Shrublands	Caatinga	Photograph	2007	UNB Brazil
Non-melanistic 236	Serra da Capivara National Park, Piauí, Brazil	-8,7852	-42,6315	Desert and Xeric Shrublands	Caatinga	Photograph	2007	UNB Brazil
Non-melanistic 237	Serra da Capivara National Park, Piauí, Brazil	-8,6495	-42,6301	Desert and Xeric Shrublands	Caatinga	Photograph	2007	UNB Brazil
Non-melanistic 238	Serra da Capivara National Park, Piauí, Brazil	-8,7562	-42,4818	Desert and Xeric Shrublands	Caatinga	Photograph	2007	UNB Brazil
Non-melanistic 239	Serra da Capivara National Park, Piauí, Brazil	-8,8066	-42,6736	Desert and Xeric Shrublands	Caatinga	Photograph	2007	UNB Brazil
Non-melanistic 240	Serra da Capivara National Park, Piauí, Brazil	-8,5934	-42,5537	Desert and Xeric Shrublands	Caatinga	Photograph	2007	UNB Brazil
Non-melanistic 241	Serra das Confusões National Park, Piauí, Brazil	-8,9736	-43,4451	Tropical and Subtropical Dry Broadleaf Forest	Atlantic dry forests	Report	2007	Jaguar Conservation Fund
Non-melanistic 242	Serra das Confusões National Park, Piauí, Brazil	-9,0805	-43,4126	Tropical and Subtropical Dry Broadleaf Forest	Atlantic dry forests	Report	2007	Jaguar Conservation Fund
Non-melanistic 243	Uruçuí-Una, Piauí, Brazil	-8,9670	-45,2641	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Report	2008	Jaguar Conservation Fund
Non-melanistic 244	Uruçuí-Una, Piauí, Brazil	-8,9685	-45,2998	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Report	2008	Jaguar Conservation Fund
Non-melanistic 245	Cidade Gaúcha, Paraná, Brazil	-23,3792	-53,0129	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Photograph	1972	CENAP ICMBio
Non-melanistic 246	Iguaçu National Park, Paraná, Brazil	-25,0604	-53,6326	Tropical and Subtropical Moist Broadleaf Forest	Araucaria moist forests	Report	2012	CENAP ICMBio
Non-melanistic 247	Iguaçu National Park, Paraná, Brazil	-25,6561	-54,4461	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Faecal DNA	2007	Projeto Carnívoros do Iguaçu
Non-melanistic 248	Iguaçu National Park, Paraná, Brazil	-25,6278	-54,4630	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Capture	1993	Projeto Carnívoros do Iguaçu
Non-melanistic 249	Iguaçu National Park, Paraná, Brazil	-25,5326	-54,0861	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Capture	1993	Projeto Carnívoros do Iguaçu
Non-melanistic 250	Iguaçu National Park, Paraná, Brazil	-25,5537	-54,3283	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Faecal DNA	2006	Projeto Carnívoros do Iguaçu
Non-melanistic 251	Iguaçu National Park, Paraná, Brazil	-25,5093	-54,1983	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Capture	2009	Projeto Carnívoros do Iguaçu
Non-melanistic 252	Iguaçu National Park, Paraná, Brazil	-25,6326	-54,4516	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Photograph	2009	Projeto Carnívoros do Iguaçu
Non-melanistic 253	Iguaçu National Park, Paraná, Brazil	-25,6224	-54,4058	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Faecal DNA	2007	CENAP ICMBio
Non-melanistic 254	Iguaçu National Park, Paraná, Brazil	-25,5838	-54,3955	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Faecal DNA	no data	CENAP ICMBio
Non-melanistic 255	Iguaçu National Park, Paraná, Brazil	-25,5918	-54,3644	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Photograph	no data	CENAP ICMBio
Non-melanistic 256	Iguaçu National Park, Paraná, Brazil	-25,6104	-54,4307	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Capture	1999	Projeto Carnívoros do Iguaçu
Non-melanistic 257	Iguaçu National Park, Paraná, Brazil	-25,6104	-54,4307	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Capture	1999	Projeto Carnívoros do Iguaçu
Non-melanistic 258	Iguaçu National Park, Paraná, Brazil	-25,6245	-54,4154	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Photograph	2004	Ceiba Argentina
Non-melanistic 259	Iguaçu National Park, Paraná, Brazil	-25,5076	-53,8969	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Photograph	1995	Ceiba Argentina
Non-melanistic 260	Iguaçu National Park, Paraná, Brazil	-25,2245	-53,7269	Tropical and Subtropical Moist Broadleaf Forest	Araucaria moist forests	Photograph	no data	Ceiba Argentina
Non-melanistic 261	Iguaçu National Park, Paraná, Brazil	-25,6760	-54,4349	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Photograph	no data	Projeto Carnívoros do Iguaçu
Non-melanistic 262	Itaipu Reserve, Paraná, Brazil	-24,9999	-54,3677	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Photograph	no data	IBAMA
Non-melanistic 263	Santa Tereza do Oeste, Paraná, Brazil	-25,0636	-53,6263	Tropical and Subtropical Moist Broadleaf Forest	Araucaria moist forests	Photograph	2012	Projeto Carnívoros do Iguaçu
Non-melanistic 264	Santa Tereza do Oeste, Paraná, Brazil	-25,1262	-53,6472	Tropical and Subtropical Moist Broadleaf Forest	Araucaria moist forests	Faecal DNA	2006	Projeto Carnívoros do Iguaçu
Non-melanistic 265	Chupinguaia, Rondônia	-12,6217	-60,9049	Tropical and Subtropical Moist Broadleaf Forest	Madeira-Tapajós moist forests	Photograph	2011	IBAMA
Non-melanistic 266	Porto Velho, Rondônia	-8,8787	-63,8231	Tropical and Subtropical Moist Broadleaf Forest	Monte Alegre varzeá	Photograph	no data	Instituto Mamirauá Amazonas
Non-melanistic 267	Viruá National Park, Roraima	1,3344	-61,2206	Tropical and Subtropical Moist Broadleaf Forest	Rio Negro campinarana	Photograph	no data	CENAP ICMBio
Non-melanistic 268	Jaquirana, Rio Grande do Sul, Brazil	-28,8130	-50,3134	Tropical and Subtropical Moist Broadleaf Forest	Araucaria moist forests	Capture	1975	ULBRA Brazil
Non-melanistic 269	Turvo State Park, Rio Grande do Sul, Brazil	-27,2006	-53,8997	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Capture	1993	Eizirik et al 2003
Non-melanistic 270	Turvo State Park, Rio Grande do Sul, Brazil	-27,2141	-53,9701	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Photograph	2007	UFRGS Brazil
Non-melanistic 271	São José do Cedro, Santa Catarina, Brazil	-26,3849	-53,5576	Tropical and Subtropical Moist Broadleaf Forest	Araucaria moist forests	Faecal DNA	2007	Curitiba Zoo
Non-melanistic 272	Bauru, São Paulo, Brazil	-22,2996	-48,8025	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Photograph	no data	MUZUSP Brazil
Non-melanistic 273	Fazenda Ouro Verde, Marabá Paulista, São Paulo, Brazil	-22,1399	-52,0338	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Faecal DNA	2004	Ilha Solteira Zoo
Non-melanistic 274	Fazenda Ouro Verde, Marabá Paulista, São Paulo, Brazil	-22,0872	-52,1191	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Capture	1998	Ilha Solteira Zoo
Non-melanistic 275	Mina Limeira, Ribeirão Grande, São Paulo, Brazil	-24,2169	-48,0739	Tropical and Subtropical Moist Broadleaf Forest	Serra do Mar coastal forests	Photograph	2003	Instituto Pro-Carnívoros
Non-melanistic 276	Carlos Botelho State Park, Vale do Ribeira, São Paulo, Brazil	-24,1268	-47,8781	Tropical and Subtropical Moist Broadleaf Forest	Serra do Mar coastal forests	Capture	2008	CENAP ICMBio
Non-melanistic 277	Carlos Botelho State Park, Vale do Ribeira, São Paulo, Brazil	-24,1157	-47,9937	Tropical and Subtropical Moist Broadleaf Forest	Serra do Mar coastal forests	Photograph	2011	CENAP ICMBio
Non-melanistic 278	Carlos Botelho State Park, Vale do Ribeira, São Paulo, Brazil	-24,1275	-48,0262	Tropical and Subtropical Moist Broadleaf Forest	Serra do Mar coastal forests	Photograph	2011	CENAP ICMBio
Non-melanistic 279	Carlos Botelho State Park, Vale do Ribeira, São Paulo, Brazil	-24,0814	-47,9777	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Photograph	2011	CENAP ICMBio
Non-melanistic 280	Carlos Botelho State Park, Vale do Ribeira, São Paulo, Brazil	-24,1234	-47,8276	Tropical and Subtropical Moist Broadleaf Forest	Serra do Mar coastal forests	Photograph	2010	CENAP ICMBio
Non-melanistic 281	Carlos Botelho State Park, Vale do Ribeira, São Paulo, Brazil	-24,1140	-47,9376	Tropical and Subtropical Moist Broadleaf Forest	Serra do Mar coastal forests	Photograph	2011	CENAP ICMBio
Non-melanistic 282	Carlos Botelho State Park, Vale do Ribeira, São Paulo, Brazil	-24,0801	-47,9385	Tropical and Subtropical Moist Broadleaf Forest	Serra do Mar coastal forests	Photograph	2011	CENAP ICMBio
Non-melanistic 283	Carlos Botelho State Park, Vale do Ribeira, São Paulo, Brazil	-24,0787	-47,9353	Tropical and Subtropical Moist Broadleaf Forest	Serra do Mar coastal forests	Photograph	2011	CENAP ICMBio
Non-melanistic 284	Carlos Botelho State Park, Vale do Ribeira, São Paulo, Brazil	-24,1369	-48,0676	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Photograph	2011	CENAP ICMBio
Non-melanistic 285	Carlos Botelho State Park, Vale do Ribeira, São Paulo, Brazil	-24,0993	-47,9707	Tropical and Subtropical Moist Broadleaf Forest	Serra do Mar coastal forests	Photograph	2011	CENAP ICMBio
Non-melanistic 286	Carlos Botelho State Park, Vale do Ribeira, São Paulo, Brazil	-24,1833	-47,9703	Tropical and Subtropical Moist Broadleaf Forest	Serra do Mar coastal forests	Photograph	2009	CENAP ICMBio
Non-melanistic 287	Carlos Botelho State Park, Vale do Ribeira, São Paulo, Brazil	-24,1385	-47,8918	Tropical and Subtropical Moist Broadleaf Forest	Serra do Mar coastal forests	Photograph	2009	CENAP ICMBio
Non-melanistic 288	Carlos Botelho State Park, Vale do Ribeira, São Paulo, Brazil	-24,1185	-47,9610	Tropical and Subtropical Moist Broadleaf Forest	Serra do Mar coastal forests	Photograph	no data	UNESP Brazil

Samples	Locality / Country	Deg-WGS84		Biome	Ecoregion	Sample type	Year	Information Source
		Lat	Long					
Non-melanistic 289	Intervales State Park, São Paulo, Brazil	-24,7443	-48,5961	Tropical and Subtropical Moist Broadleaf Forest	Serra do Mar coastal forests	Report	no data	UNESP Brazil
Non-melanistic 290	Morro do Diabo State Park, São Paulo, Brazil	-22,6278	-52,1679	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Capture	2004	Instituto de Pesquisas Ecológicas
Non-melanistic 291	Morro do Diabo State Park, São Paulo, Brazil	-22,5954	-52,2661	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Capture	2004	Instituto de Pesquisas Ecológicas
Non-melanistic 292	Morro do Diabo State Park, São Paulo, Brazil	-22,6290	-52,1696	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Capture	2002	Instituto de Pesquisas Ecológicas
Non-melanistic 293	Morro do Diabo State Park, São Paulo, Brazil	-22,5938	-52,2664	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Capture	2000	Instituto de Pesquisas Ecológicas
Non-melanistic 294	Morro do Diabo State Park, São Paulo, Brazil	-22,6326	-52,2685	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Capture	2003	Instituto de Pesquisas Ecológicas
Non-melanistic 295	Morro do Diabo State Park, São Paulo, Brazil	-22,4470	-52,3072	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Photograph	no data	Instituto de Pesquisas Ecológicas
Non-melanistic 296	Morro do Diabo State Park, São Paulo, Brazil	-22,5662	-52,2335	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Photograph	no data	Instituto de Pesquisas Ecológicas
Non-melanistic 297	Morro do Diabo State Park, São Paulo, Brazil	-22,5844	-52,2550	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Photograph	2007	Instituto de Pesquisas Ecológicas
Non-melanistic 298	Pereira Barreto, São Paulo, Brazil	-20,6389	-51,1099	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Capture	1993	Ilha Solteira Zoo
Non-melanistic 299	Porto Primavera, São Paulo, Brazil	-22,4871	-52,9198	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Faecal DNA	2004	Ilha Solteira Zoo
Non-melanistic 300	Praia Grande/São Vicente, São Paulo, Brazil	-23,9906	-46,4465	Tropical and Subtropical Moist Broadleaf Forest	Serra do Mar coastal forests	Photograph	2012	CENAP ICMBio
Non-melanistic 301	Cantão State Park, Tocantins, Brazil	-9,7434	-50,1181	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Capture	2006	Jaguar Conservation Fund
Non-melanistic 302	Cantão State Park, Tocantins, Brazil	-9,5599	-50,0657	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Capture	2006	Jaguar Conservation Fund
Non-melanistic 303	Cantão State Park, Tocantins, Brazil	-9,5240	-49,9477	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Capture	2006	Jaguar Conservation Fund
Non-melanistic 304	Cantão State Park, Tocantins, Brazil	-9,7434	-50,1181	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Photograph	no data	Jaguar Conservation Fund
Non-melanistic 305	Cantão State Park, Tocantins, Brazil	-9,5599	-50,0657	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Photograph	no data	Jaguar Conservation Fund
Non-melanistic 306	Cantão State Park, Tocantins, Brazil	-9,5240	-49,9477	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Photograph	no data	Jaguar Conservation Fund
Non-melanistic 307	Nascentes do Rio Parnaíba National Park, Tocantins, Brazil	-10,3265	-45,8512	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Photograph	no data	Jaguar Conservation Fund
Non-melanistic 308	Pedro Afonso, Tocantins, Brazil	-9,0599	-48,1798	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Photograph	no data	IBAMA
Non-melanistic 309	Pedro Afonso, Tocantins, Brazil	-9,0599	-48,1798	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Photograph	no data	IBAMA
Non-melanistic 310	Pedro Afonso, Tocantins, Brazil	-9,0599	-48,1798	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Photograph	no data	IBAMA
Non-melanistic 311	Baritu National Park, Argentina	-23,1569	-64,6304	Tropical and Subtropical Moist Broadleaf Forest	Southern Andean Yungas	Photograph	no data	Ceiba Argentina
Non-melanistic 312	Colonia La Flor, Misiones, Argentina	-26,9951	-54,1263	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Photograph	no data	Ceiba Argentina
Non-melanistic 313	Montecarlo, Misiones, Argentina	-26,6554	-54,5805	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Faecal DNA	2005	Ceiba Argentina
Non-melanistic 314	P. P. Uruguaí, Misiones, Argentina	-25,9059	-54,2257	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Faecal DNA	2006	Ceiba Argentina
Non-melanistic 315	P. P. Uruguaí, Misiones, Argentina	-25,8219	-54,1205	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Faecal DNA	2005	Ceiba Argentina
Non-melanistic 316	P. P. Uruguaí, Misiones, Argentina	-25,9090	-54,2518	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Faecal DNA	2006	Ceiba Argentina
Non-melanistic 317	Parque Iguazu, Missiones, Argentina	-25,7259	-54,4726	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Capture	1994	Ceiba Argentina
Non-melanistic 318	Parque Iguazu, Missiones, Argentina	-25,7472	-54,4268	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Capture	1994	CENAP ICMBio
Non-melanistic 319	Parque Iguazu, Missiones, Argentina	-25,7499	-54,3973	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Photograph	no data	Ceiba Argentina
Non-melanistic 320	Parque Iguazu, Missiones, Argentina	-25,7220	-54,4530	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Photograph	no data	Ceiba Argentina
Non-melanistic 321	Parque Iguazu, Missiones, Argentina	-25,7122	-54,4718	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Photograph	no data	Ceiba Argentina
Non-melanistic 322	Parque Iguazu, Missiones, Argentina	-25,6485	-54,4936	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Photograph	no data	Ceiba Argentina
Non-melanistic 323	Puerto Libertad, Misiones, Argentina	-25,9226	-54,5800	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Photograph	1995	Ceiba Argentina
Non-melanistic 324	Reserva de Biósfera Yabotí, Argentina	-27,0773	-53,9883	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Photograph	2005	Ceiba Argentina
Non-melanistic 325	Ruiz Montoya, Misiones, Argentina	-26,9848	-54,9361	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Capture	no data	Ceiba Argentina
Non-melanistic 326	San Vicente, Misiones, Argentina	-26,8606	-54,5496	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Photograph	2004	Ceiba Argentina
Non-melanistic 327	Cockscomb Wildlife Sanctuary, Belize	16,7144	-88,7259	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	no data	Silver et al 2004
Non-melanistic 328	Golden Stream Corridor Preserve, Belize	16,2448	-88,8508	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	no data	Jaguar Conservation Fund
Non-melanistic 329	Noj Kax Meen Elijio Panti National Park, Belize	17,0109	-89,0574	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	no data	Jaguar Conservation Fund
Non-melanistic 330	The Mountain Pine Ridge Forest Reserve, Belize	16,9608	-88,9980	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	2007	Jaguar Conservation Fund
Non-melanistic 331	Madidi National Park, Bolivia	-12,6875	-68,4434	Tropical and Subtropical Moist Broadleaf Forest	Southwest Amazon moist forests	Photograph	no data	Silver et al 2004
Non-melanistic 332	Madidi National Park, Bolivia	-12,9029	-68,7238	Tropical and Subtropical Moist Broadleaf Forest	Southwest Amazon moist forests	Photograph	2011	WCS Bolivia Program
Non-melanistic 333	Madidi National Park, Bolivia	-13,2480	-68,2719	Tropical and Subtropical Moist Broadleaf Forest	Southwest Amazon moist forests	Photograph	2011	WCS Bolivia Program
Non-melanistic 334	Madidi National Park, Bolivia	-12,7655	-68,6229	Tropical and Subtropical Moist Broadleaf Forest	Southwest Amazon moist forests	Photograph	no data	Wallace et al 2003
Non-melanistic 335	Madidi National Park, Bolivia	-12,8202	-68,6865	Tropical and Subtropical Grasslands, Savannas and Shrublands	Beni savanna	Photograph	no data	Wallace et al 2004
Non-melanistic 336	Madidi National Park, Bolivia	-13,0698	-68,4808	Tropical and Subtropical Moist Broadleaf Forest	Southwest Amazon moist forests	Photograph	no data	Wallace et al 2005
Non-melanistic 337	Madidi National Park, Bolivia	-13,2999	-68,6342	Tropical and Subtropical Moist Broadleaf Forest	Southwest Amazon moist forests	Photograph	no data	Wallace et al 2006
Non-melanistic 338	Santa Cruz, Bolivia	-17,0949	-62,4658	Tropical and Subtropical Dry Broadleaf Forest	Chiquitano dry forests	Report	no data	Eizirik et al 2003
Non-melanistic 339	Santa Cruz, Bolivia	-17,1300	-62,4486	Tropical and Subtropical Dry Broadleaf Forest	Chiquitano dry forests	Photograph	no data	UFMG Brazil
Non-melanistic 340	Kaa-Iya National Park, Bolivia	-18,4410	-61,3657	Tropical and Subtropical Grasslands, Savannas and Shrublands	Dry Chaco	Photograph	no data	UFMG Brazil
Non-melanistic 341	San Miguelito Reserve, Santa Cruz, Bolivia	-16,7425	-61,0598	Tropical and Subtropical Dry Broadleaf Forest	Chiquitano dry forests	Photograph	no data	Arispe et al 2007
Non-melanistic 342	Amazonas, Araracuara, Colombia	-2,2575	-70,8027	Tropical and Subtropical Moist Broadleaf Forest	Purus varzeá	Report	2001	Panthera
Non-melanistic 343	Amazonas, La Pedrera, Colombia	-1,2663	-69,6451	Tropical and Subtropical Moist Broadleaf Forest	Caqueta moist forests	Report	2005	Panthera
Non-melanistic 344	Amazonas, Leticia, Colombia	-4,1499	-69,9495	Tropical and Subtropical Moist Broadleaf Forest	Solimões-Japurá moist forests	Report	2001	Panthera
Non-melanistic 345	Amazonas, Puerto Nariño, Colombia	4,9522	-67,8576	Tropical and Subtropical Grasslands, Savannas and Shrublands	Llanos	Report	2006	Panthera
Non-melanistic 346	Amazonas, Rio Bernardo, Colombia	-1,5016	-70,3948	Tropical and Subtropical Moist Broadleaf Forest	Solimões-Japurá moist forests	Report	1970	Panthera
Non-melanistic 347	Amazonas, Cahuinari River, Colombia	1,3915	-75,5901	Tropical and Subtropical Moist Broadleaf Forest	Napo moist forests	Report	1970	Panthera
Non-melanistic 348	Amazonas, Igará-Paraná River, La Chorrera, Colombia	-0,7608	-73,0159	Tropical and Subtropical Moist Broadleaf Forest	Solimões-Japurá moist forests	Report	1984	Panthera

Samples	Locality / Country	Deg-WGS84		Biome	Ecoregion	Sample type	Year	Information Source
		Lat	Long					
Non-melanistic 349	Amazonas, Mesai River, Colombia	0,0227	-72,0614	Tropical and Subtropical Moist Broadleaf Forest	Caqueta moist forests	Report	1970	Panthera
Non-melanistic 350	Amazonas, Yarí River, Colombia	-0,4877	-72,3316	Tropical and Subtropical Moist Broadleaf Forest	Caqueta moist forests	Report	1970	Panthera
Non-melanistic 351	Antioquia, Apartadó, Colombia	6,0593	-69,3997	Tropical and Subtropical Grasslands, Savannas and Shrublands	Llanos	Report	1974	Panthera
Non-melanistic 352	Antioquia, El Tigre, Colombia	6,9069	-74,8044	Tropical and Subtropical Moist Broadleaf Forest	Magdalena Valley montane forests	Report	1999	Panthera
Non-melanistic 353	Antioquia, Puerto Berrio, Colombia	6,4728	-74,3309	Tropical and Subtropical Moist Broadleaf Forest	Magdalena-Urabá moist forests	Report	2008	Panthera
Non-melanistic 354	Antioquia, Puerto Berrio, Colombia	6,4417	-74,2889	Tropical and Subtropical Moist Broadleaf Forest	Magdalena-Urabá moist forests	Report	2009	Panthera
Non-melanistic 355	Arauca, Colombia	7,0695	-70,7782	Tropical and Subtropical Grasslands, Savannas and Shrublands	Llanos	Report	1976	Panthera
Non-melanistic 356	Arauca, El Tigre, Colombia	6,7715	-74,7846	Tropical and Subtropical Moist Broadleaf Forest	Magdalena Valley montane forests	Report	1999	Panthera
Non-melanistic 357	Arauca, Lipa River, Colombia	6,7767	-70,1440	Tropical and Subtropical Grasslands, Savannas and Shrublands	Llanos	Report	1977	Panthera
Non-melanistic 358	Bolivar, Colombia	8,5678	-74,1957	Tropical and Subtropical Moist Broadleaf Forest	Magdalena-Urabá moist forests	Report	2009	Panthera
Non-melanistic 359	Bolivar, Colombia	8,5611	-74,1890	Tropical and Subtropical Moist Broadleaf Forest	Magdalena-Urabá moist forests	Report	2009	Panthera
Non-melanistic 360	Bolivar, Colombia	8,5741	-74,1935	Tropical and Subtropical Moist Broadleaf Forest	Magdalena-Urabá moist forests	Report	2006	Panthera
Non-melanistic 361	Bolivar, Isla del Cobado Arjona, Colombia	5,8143	-75,9785	Tropical and Subtropical Moist Broadleaf Forest	Cauca Valley montane forests	Report	2001	Panthera
Non-melanistic 362	Caquetá, Caguán, Colombia	0,3379	-75,0421	Tropical and Subtropical Moist Broadleaf Forest	Napo moist forests	Report	1971	Panthera
Non-melanistic 363	Caquetá, San Antonio, Colombia	1,8126	-78,2515	Tropical and Subtropical Moist Broadleaf Forest	Chocó-Darién moist forests	Report	1971	Panthera
Non-melanistic 364	Casanare, Colombia	6,1796	-70,0806	Tropical and Subtropical Grasslands, Savannas and Shrublands	Llanos	Report	2009	Panthera
Non-melanistic 365	Casanare, Colombia	6,1820	-70,0680	Tropical and Subtropical Grasslands, Savannas and Shrublands	Llanos	Report	2010	Panthera
Non-melanistic 366	Casanare, Colombia	6,8489	-74,7775	Tropical and Subtropical Moist Broadleaf Forest	Magdalena Valley montane forests	Report	1999	Panthera
Non-melanistic 367	Casanare, Colombia	4,4653	-72,3479	Tropical and Subtropical Grasslands, Savannas and Shrublands	Llanos	Report	1999	Panthera
Non-melanistic 368	Casanare, Finca Managua, Colombia	6,2693	-70,1782	Tropical and Subtropical Grasslands, Savannas and Shrublands	Llanos	Report	2005	Panthera
Non-melanistic 369	Casanare, La Tigrera, Colombia	4,4481	-75,3401	Tropical and Subtropical Moist Broadleaf Forest	Magdalena Valley montane forests	Report	1999	Panthera
Non-melanistic 370	Cauca, Colombia	7,9603	-75,1473	Tropical and Subtropical Moist Broadleaf Forest	Magdalena-Urabá moist forests	Report	1999	Panthera
Non-melanistic 371	Cesar, Colombia	8,7152	-73,5306	Tropical and Subtropical Moist Broadleaf Forest	Magdalena Valley montane forests	Report	2010	Panthera
Non-melanistic 372	Cesar, Colombia	9,8374	-73,1936	Tropical and Subtropical Moist Broadleaf Forest	Cordillera Oriental montane forests	Report	2003	Panthera
Non-melanistic 373	Cesar, Colombia	8,9810	-73,4584	Tropical and Subtropical Moist Broadleaf Forest	Magdalena Valley montane forests	Report	2009	Panthera
Non-melanistic 374	Cesar, Colombia	8,0119	-73,7183	Tropical and Subtropical Moist Broadleaf Forest	Magdalena-Urabá moist forests	Report	2008	Panthera
Non-melanistic 375	Cesar, Colombia	7,9881	-73,6057	Tropical and Subtropical Moist Broadleaf Forest	Magdalena-Urabá moist forests	Report	2007	Panthera
Non-melanistic 376	Cesar, Colombia	7,9212	-73,7349	Tropical and Subtropical Moist Broadleaf Forest	Magdalena-Urabá moist forests	Report	2010	Panthera
Non-melanistic 377	Chocó, Ciénaga La Isla, Colombia	10,3576	-74,9527	Tropical and Subtropical Dry Broadleaf Forest	Sinú Valley dry forests	Report	2007	Panthera
Non-melanistic 378	Los Katios National Park, Colombia	7,8415	-77,2481	Tropical and Subtropical Moist Broadleaf Forest	Chocó-Darién moist forests	Report	2005	Panthera
Non-melanistic 379	Cundinamarca, Guaduas, Colombia	5,0676	-74,5969	Tropical and Subtropical Moist Broadleaf Forest	Magdalena Valley montane forests	Report	1999	Panthera
Non-melanistic 380	Cundinamarca, Junin, Colombia	1,3405	-78,1013	Tropical and Subtropical Moist Broadleaf Forest	Northwestern Andean montane forests	Report	2005	Panthera
Non-melanistic 381	Guainía, Colombia	2,5844	-67,5182	Tropical and Subtropical Moist Broadleaf Forest	Japurá-Solimoes-Negro moist forests	Report	1999	Panthera
Non-melanistic 382	Guainía, Isana River, Colombia	2,5025	-67,3634	Tropical and Subtropical Moist Broadleaf Forest	Japurá-Solimoes-Negro moist forests	Report	1975	Panthera
Non-melanistic 383	Guainía, Isana River, Colombia	2,6181	-67,5940	Tropical and Subtropical Moist Broadleaf Forest	Japurá-Solimoes-Negro moist forests	Report	1975	Panthera
Non-melanistic 384	Guaviare, Reserva Natural Nukak, Colombia	1,7206	-71,9339	Tropical and Subtropical Moist Broadleaf Forest	Caqueta moist forests	Report	2001	Panthera
Non-melanistic 385	Guaviare, Guayabero River, Colombia	2,6586	-72,5773	Tropical and Subtropical Moist Broadleaf Forest	Negro-Branco moist forests	Report	1970	Panthera
Non-melanistic 386	Guaviare, Itilla River, Colombia	2,9057	-72,2872	Tropical and Subtropical Grasslands, Savannas and Shrublands	Llanos	Report	1971	Panthera
Non-melanistic 387	Guaviare, Itilla River, Colombia	2,8378	-72,5883	Tropical and Subtropical Grasslands, Savannas and Shrublands	Llanos	Report	1975	Panthera
Non-melanistic 388	Isla de Los Palacios, Colombia	7,0596	-76,8834	Tropical and Subtropical Moist Broadleaf Forest	Chocó-Darién moist forests	Photograph	2008	Reina & Maya 2008
Non-melanistic 389	Magdalena, Colombia	6,9301	-74,0228	Tropical and Subtropical Moist Broadleaf Forest	Magdalena-Urabá moist forests	Report	2008	Panthera
Non-melanistic 390	Magdalena Medio, Barrancabermeja, Colombia	7,1434	-73,9519	Tropical and Subtropical Moist Broadleaf Forest	Magdalena-Urabá moist forests	Report	2007	Panthera
Non-melanistic 391	Meta, Mesetas, Colombia	5,5236	-70,3238	Tropical and Subtropical Grasslands, Savannas and Shrublands	Llanos	Report	1997	Panthera
Non-melanistic 392	Meta, Sierra de la Macarena National Park, Colombia	2,5049	-73,1495	Tropical and Subtropical Moist Broadleaf Forest	Caqueta moist forests	Report	2005	Panthera
Non-melanistic 393	Meta, Trujillo, Colombia	4,1517	-76,3164	Tropical and Subtropical Moist Broadleaf Forest	Cauca Valley montane forests	Report	1999	Panthera
Non-melanistic 394	Nariño, Colombia	4,9386	-67,8587	Tropical and Subtropical Grasslands, Savannas and Shrublands	Llanos	Report	1999	Panthera
Non-melanistic 395	Nariño, El Carmen, Córdoba, Colombia	0,9778	-77,6203	Tropical and Subtropical Moist Broadleaf Forest	Northwestern Andean montane forests	Report	2009	Panthera
Non-melanistic 396	Nariño, La Guaraperia, Junín, Colombia	1,3457	-78,0899	Tropical and Subtropical Moist Broadleaf Forest	Northwestern Andean montane forests	Report	1998	Panthera
Non-melanistic 397	Nariño, La Planada, Ricaurte, Colombia	5,0403	-67,8246	Tropical and Subtropical Grasslands, Savannas and Shrublands	Llanos	Report	2009	Panthera
Non-melanistic 398	Nariño, Orito Ingi-Andes National Park, Colombia	0,7198	-77,0394	Tropical and Subtropical Moist Broadleaf Forest	Eastern Cordillera real montane forests	Report	2009	Panthera
Non-melanistic 399	North Santander, La Tigra, Colombia	7,3588	-73,4236	Tropical and Subtropical Moist Broadleaf Forest	Magdalena-Urabá moist forests	Report	1999	Panthera
Non-melanistic 400	Paramillo National Park, Colombia	7,6531	-76,3974	Tropical and Subtropical Moist Broadleaf Forest	Magdalena-Urabá moist forests	Report	2001	Panthera
Non-melanistic 401	Sierra Nevada de Santa Marta National Park, Colombia	10,9257	-73,4407	Tropical and Subtropical Moist Broadleaf Forest	Santa Marta montane forests	Report	2005	Panthera
Non-melanistic 402	Santa Clara, Colombia	-2,6475	-69,6997	Tropical and Subtropical Moist Broadleaf Forest	Solimões-Japurá moist forests	Photograph	2012	Panthera
Non-melanistic 403	Santander, Colombia	3,0211	-76,4930	Tropical and Subtropical Moist Broadleaf Forest	Cauca Valley montane forests	Report	2009	Panthera
Non-melanistic 404	Santander, Colombia	7,5297	-73,7753	Tropical and Subtropical Moist Broadleaf Forest	Magdalena-Urabá moist forests	Report	2010	Panthera
Non-melanistic 405	Santander, Colombia	7,4887	-73,7713	Tropical and Subtropical Moist Broadleaf Forest	Magdalena-Urabá moist forests	Report	2008	Panthera
Non-melanistic 406	Santander, Colombia	5,7477	-72,0313	Tropical and Subtropical Dry Broadleaf Forest	Apure-Villavicencio dry forests	Report	2008	Panthera
Non-melanistic 407	Santander, Colombia	5,7726	-72,0119	Tropical and Subtropical Dry Broadleaf Forest	Apure-Villavicencio dry forests	Report	2008	Panthera
Non-melanistic 408	Santander, Colombia	5,7414	-72,0372	Tropical and Subtropical Dry Broadleaf Forest	Apure-Villavicencio dry forests	Report	2007	Panthera

Samples	Locality / Country	Deg-WGS84		Biome	Ecoregion	Sample type	Year	Information Source
		Lat	Long					
Non-melanistic 409	Santander, Colombia	5,7407	-72,0319	Tropical and Subtropical Dry Broadleaf Forest	Apure-Villavicencio dry forests	Report	2009	Panthera
Non-melanistic 410	Santander, Colombia	5,7149	-72,0573	Tropical and Subtropical Dry Broadleaf Forest	Apure-Villavicencio dry forests	Report	2010	Panthera
Non-melanistic 411	Santander, Colombia	5,7201	-72,0827	Tropical and Subtropical Dry Broadleaf Forest	Apure-Villavicencio dry forests	Report	2007	Panthera
Non-melanistic 412	Santander, Colombia	5,6400	-72,3211	Tropical and Subtropical Moist Broadleaf Forest	Cordillera Oriental montane forests	Report	2011	Panthera
Non-melanistic 413	Santander, Cimitarra, Colombia	6,2915	-73,9393	Tropical and Subtropical Moist Broadleaf Forest	Magdalena Valley montane forests	Report	2004	Panthera
Non-melanistic 414	Santander, Cimitarra, Colombia	6,2758	-73,9655	Tropical and Subtropical Moist Broadleaf Forest	Magdalena Valley montane forests	Report	2008	Panthera
Non-melanistic 415	Santander, El Tigre, Colombia	6,8894	-74,7835	Tropical and Subtropical Moist Broadleaf Forest	Magdalena Valley montane forests	Report	1999	Panthera
Non-melanistic 416	Santander, La Tigra, Colombia	6,8963	-74,7765	Tropical and Subtropical Moist Broadleaf Forest	Magdalena Valley montane forests	Report	1999	Panthera
Non-melanistic 417	Santander, Magdalena Medio, Puerto Berrío, Colombia	6,5172	-74,4758	Tropical and Subtropical Moist Broadleaf Forest	Magdalena-Urabá moist forests	Report	1971	Panthera
Non-melanistic 418	Sucre, Colombia	8,8185	-74,7479	Tropical and Subtropical Moist Broadleaf Forest	Magdalena-Urabá moist forests	Report	1999	Panthera
Non-melanistic 419	Sucre, Corregimiento de Bocacerrada, San Onofre, Colombia	9,7347	-75,5086	Desert and Xeric Shrublands	Guajira-Barranquilla xeric scrub	Report	2001	Panthera
Non-melanistic 420	Sucre, Corregimiento de Labarcé, San Onofre, Colombia	9,7187	-75,5271	Desert and Xeric Shrublands	Guajira-Barranquilla xeric scrub	Report	1998	Panthera
Non-melanistic 421	Tolima, Colombia	4,5583	-75,1182	Tropical and Subtropical Moist Broadleaf Forest	Magdalena Valley montane forests	Report	1999	Panthera
Non-melanistic 422	Valle del Cauca, Colombia	3,8262	-76,6653	Tropical and Subtropical Moist Broadleaf Forest	Northwestern Andean montane forests	Report	1999	Panthera
Non-melanistic 423	Vaupes, Miraflores, Colombia	1,6096	-72,2928	Tropical and Subtropical Moist Broadleaf Forest	Caqueta moist forests	Report	1957	Panthera
Non-melanistic 424	Vaupes, Miraflores, Colombia	1,5766	-72,2452	Tropical and Subtropical Moist Broadleaf Forest	Caqueta moist forests	Report	2003	Panthera
Non-melanistic 425	Vaupes, Apaporis River, Jijirimo, Colombia	1,4863	-72,3815	Tropical and Subtropical Moist Broadleaf Forest	Caqueta moist forests	Report	1970	Panthera
Non-melanistic 426	Vaupés, Yuruparí, Colombia	1,5961	-72,2973	Tropical and Subtropical Moist Broadleaf Forest	Caqueta moist forests	Report	1975	Panthera
Non-melanistic 427	Vereda La Chapa, Colombia	2,9340	-76,5221	Tropical and Subtropical Moist Broadleaf Forest	Cauca Valley montane forests	Report	2008	Panthera
Non-melanistic 428	Vichada, Colombia	3,5505	-69,1797	Tropical and Subtropical Moist Broadleaf Forest	Negro-Branco moist forests	Report	2010	Panthera
Non-melanistic 429	Vichada, Colombia	3,5505	-69,1953	Tropical and Subtropical Moist Broadleaf Forest	Negro-Branco moist forests	Report	2010	Panthera
Non-melanistic 430	Vichada, Colombia	3,4106	-68,9762	Tropical and Subtropical Moist Broadleaf Forest	Negro-Branco moist forests	Report	2007	Panthera
Non-melanistic 431	Vichada, Colombia	4,5596	-68,7225	Tropical and Subtropical Moist Broadleaf Forest	Negro-Branco moist forests	Report	2008	Panthera
Non-melanistic 432	Vichada, Colombia	4,2361	-69,0322	Tropical and Subtropical Moist Broadleaf Forest	Negro-Branco moist forests	Report	2010	Panthera
Non-melanistic 433	Vichada, Colombia	4,3744	-68,4130	Tropical and Subtropical Moist Broadleaf Forest	Negro-Branco moist forests	Report	2010	Panthera
Non-melanistic 434	Vichada, Colombia	4,4747	-68,8774	Tropical and Subtropical Moist Broadleaf Forest	Negro-Branco moist forests	Report	1990	Panthera
Non-melanistic 435	Vichada, Colombia	3,7068	-68,6312	Tropical and Subtropical Moist Broadleaf Forest	Negro-Branco moist forests	Report	2010	Panthera
Non-melanistic 436	Vichada, Colombia	4,0869	-68,3705	Tropical and Subtropical Moist Broadleaf Forest	Negro-Branco moist forests	Report	2011	Panthera
Non-melanistic 437	Vichada, Bohonawi, El Tuparro National Park, Colombia	5,5985	-68,2550	Tropical and Subtropical Grasslands, Savannas and Shrublands	Llanos	Report	2005	Panthera
Non-melanistic 438	Vichada, Brazo Amanaven, Colombia	5,5763	-68,5796	Tropical and Subtropical Grasslands, Savannas and Shrublands	Llanos	Report	2005	Panthera
Non-melanistic 439	Vichada, Caño Grande, Colombia	4,6380	-68,6470	Tropical and Subtropical Moist Broadleaf Forest	Negro-Branco moist forests	Report	2000	Panthera
Non-melanistic 440	Vichada, Caño Juriepe, Colombia	6,2689	-67,7266	Tropical and Subtropical Grasslands, Savannas and Shrublands	Llanos	Report	2005	Panthera
Non-melanistic 441	Vichada, Cumaribo, Colombia	4,8361	-71,5322	Tropical and Subtropical Grasslands, Savannas and Shrublands	Llanos	Report	2010	Panthera
Non-melanistic 442	Vichada, El Tapón, El Tuparro National Park, Colombia	6,2823	-67,8075	Tropical and Subtropical Grasslands, Savannas and Shrublands	Llanos	Report	2005	Panthera
Non-melanistic 443	Vichada, El Tuparro National Park, Colombia	4,8272	-68,0456	Tropical and Subtropical Moist Broadleaf Forest	Negro-Branco moist forests	Report	1973	Panthera
Non-melanistic 444	Vichada, Finca El Palito, Colombia	6,1732	-67,9094	Tropical and Subtropical Grasslands, Savannas and Shrublands	Llanos	Report	2005	Panthera
Non-melanistic 445	Vichada, Finca Monserrate, Colombia	5,6383	-68,0678	Tropical and Subtropical Grasslands, Savannas and Shrublands	Llanos	Report	2005	Panthera
Non-melanistic 446	Vichada, Gaviotas, Colombia	4,5905	-70,8805	Tropical and Subtropical Grasslands, Savannas and Shrublands	Llanos	Report	2009	Panthera
Non-melanistic 447	Vichada, La Arenosa, Colombia	5,7328	-69,9579	Tropical and Subtropical Grasslands, Savannas and Shrublands	Llanos	Report	1999	Panthera
Non-melanistic 448	Vichada, El Tuparro National Park, Colombia	5,4068	-68,1065	Tropical and Subtropical Grasslands, Savannas and Shrublands	Llanos	Report	2005	Panthera
Non-melanistic 449	Vichada, Muco River, Colombia	4,6522	-68,9213	Tropical and Subtropical Grasslands, Savannas and Shrublands	Llanos	Report	2000	Panthera
Non-melanistic 450	Vichada, Siare River, Colombia	4,9047	-68,3802	Tropical and Subtropical Grasslands, Savannas and Shrublands	Llanos	Report	1970	Panthera
Non-melanistic 451	Vichada, Tuparrito River, Colombia	3,5743	-69,2157	Tropical and Subtropical Moist Broadleaf Forest	Negro-Branco moist forests	Report	2005	Panthera
Non-melanistic 452	Vichada, Tuparro River, Colombia	3,2592	-68,6016	Tropical and Subtropical Moist Broadleaf Forest	Negro-Branco moist forests	Report	2005	Panthera
Non-melanistic 453	Vichada, Santa Helena, Colombia	2,6802	-72,7986	Tropical and Subtropical Dry Broadleaf Forest	Apure-Villavicencio dry forests	Report	1999	Panthera
Non-melanistic 454	Vichada, Serrania Albarical, Colombia	4,8423	-67,9547	Tropical and Subtropical Moist Broadleaf Forest	Negro-Branco moist forests	Report	2005	Panthera
Non-melanistic 455	Charripo, Costa Rica	9,6445	-83,2526	Tropical and Subtropical Moist Broadleaf Forest	Talamancan montane forests	Photograph	no data	Panthera
Non-melanistic 456	Corcovado National Park, Costa Rica	8,6024	-83,5627	Tropical and Subtropical Moist Broadleaf Forest	Isthmian-Pacific moist forests	Photograph	2010	Panthera
Non-melanistic 457	Corcovado National Park, Costa Rica	8,6024	-83,5627	Tropical and Subtropical Moist Broadleaf Forest	Isthmian-Pacific moist forests	Photograph	2010	Panthera
Non-melanistic 458	Osa Biodiversity Research Center, Costa Rica	8,5399	-83,4262	Tropical and Subtropical Moist Broadleaf Forest	Isthmian-Pacific moist forests	Photograph	no data	Panthera
Non-melanistic 459	Puerto Limon, Costa Rica	9,9684	-83,0424	Tropical and Subtropical Moist Broadleaf Forest	Isthmian-Atlantic moist forests	Report	no data	Eizirik et al 2003
Non-melanistic 460	Upala, Alajuela, Costa Rica	10,8129	-85,0320	Tropical and Subtropical Moist Broadleaf Forest	Isthmian-Atlantic moist forests	Report	no data	Eizirik et al 2003
Non-melanistic 461	Ecuatorian Amazon, Ecuador	-1,0716	-75,5368	Tropical and Subtropical Moist Broadleaf Forest	Napo moist forests	Photograph	2009	Panthera
Non-melanistic 462	Houarani Ecolodge, Ecuador	-1,3223	-75,9486	Tropical and Subtropical Moist Broadleaf Forest	Napo moist forests	Photograph	no data	Panthera
Non-melanistic 463	Tiputini Biological Station , Ecuador	0,0625	-78,6470	Tropical and Subtropical Moist Broadleaf Forest	Northwestern Andean montane forests	Photograph	no data	Panthera
Non-melanistic 464	Tiputini Biological Station, Ecuador	0,0164	-78,6720	Tropical and Subtropical Moist Broadleaf Forest	Northwestern Andean montane forests	Photograph	no data	Panthera
Non-melanistic 465	Yasuní National Park, Ecuador	-0,5593	-76,6567	Tropical and Subtropical Moist Broadleaf Forest	Napo moist forests	Photograph	no data	World Wild Fund
Non-melanistic 466	Yasuní National Park, Ecuador	-0,5593	-76,6567	Tropical and Subtropical Moist Broadleaf Forest	Napo moist forests	Photograph	2010	World Wild Fund
Non-melanistic 467	Arizona, United States	32,1765	-110,8795	Desert and Xeric Shrublands	Sonoran desert	Photograph	1965	Brown & Gonzalez 2000
Non-melanistic 468	Cochise County, Mountains of Southeastern Arizona, United States	31,3736	-110,7216	Tropical and Subtropical Coniferous Forests	Sierra Madre Occidental pine-oak forests	Photograph	2011	Northern Jaguar Project

Samples	Locality / Country	Deg-WGS84		Biome	Ecoregion	Sample type	Year	Information Source
		Lat	Long					
Non-melanistic 469	Graterville, Arizona, United States	31,6910	-110,7896	Tropical and Subtropical Coniferous Forests	Sierra Madre Occidental pine-oak forests	Photograph	1919	National Museum of Natural History USA
Non-melanistic 470	Helveta, Arizona, United States	31,7646	-110,7478	Tropical and Subtropical Coniferous Forests	Sierra Madre Occidental pine-oak forests	Photograph	1917	National Museum of Natural History USA
Non-melanistic 471	Mills County, Texas, United States	31,4523	-98,7370	Temperate Grasslands, Savannas and Shrublands	Central forest-grasslands transition	Photograph	1903	National Museum of Natural History USA
Non-melanistic 472	Southern Arizona, United States	31,4754	-111,2030	Desert and Xeric Shrublands	Chihuahuan desert	Photograph	2004	National Museum of Natural History USA
Non-melanistic 473	Arbolverde, Yaloch, Guatemala	17,2942	-89,2449	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	2009	Wildlife Conservation Society
Non-melanistic 474	Arbolverde, Yaloch, Guatemala	17,3188	-89,2512	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	2009	Wildlife Conservation Society
Non-melanistic 475	Arbolverde, Yaloch, Guatemala	17,3585	-89,2456	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	2009	Wildlife Conservation Society
Non-melanistic 476	Arbolverde, Yaloch, Guatemala	17,3514	-89,2235	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	2005	Wildlife Conservation Society
Non-melanistic 477	Arbolverde, Yaloch, Guatemala	17,3188	-89,2512	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	2005	Wildlife Conservation Society
Non-melanistic 478	Arbolverde, Yaloch, Guatemala	17,2890	-89,2789	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	2009	Wildlife Conservation Society
Non-melanistic 479	Arbolverde, Yaloch, Guatemala	17,3390	-89,2340	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	2009	Wildlife Conservation Society
Non-melanistic 480	Arbolverde, Yaloch, Guatemala	17,3675	-89,2160	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	2009	Wildlife Conservation Society
Non-melanistic 481	Burral, Guatemala	17,3600	-90,3693	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	2011	Wildlife Conservation Society
Non-melanistic 482	Burral, Guatemala	17,3600	-90,3693	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	2011	Wildlife Conservation Society
Non-melanistic 483	Burral, Guatemala	17,3299	-90,3633	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	2008	Wildlife Conservation Society
Non-melanistic 484	Burral, Guatemala	17,3202	-90,3619	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	2008	Wildlife Conservation Society
Non-melanistic 485	Burral, Guatemala	17,3659	-90,3802	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	2008	Wildlife Conservation Society
Non-melanistic 486	Burral, Guatemala	17,3657	-90,3803	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	2008	Wildlife Conservation Society
Non-melanistic 487	Burral, Guatemala	17,3299	-90,3633	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	2008	Wildlife Conservation Society
Non-melanistic 488	Burral, Guatemala	17,3497	-90,3502	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	2008	Wildlife Conservation Society
Non-melanistic 489	Burral, Guatemala	17,3566	-90,3808	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	2008	Wildlife Conservation Society
Non-melanistic 490	Burral, Guatemala	17,3361	-90,3509	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	2008	Wildlife Conservation Society
Non-melanistic 491	Burral, Guatemala	17,3093	-90,3617	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	2008	Wildlife Conservation Society
Non-melanistic 492	Carmelita Afisap, Guatemala	17,4929	-90,2009	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	2004	Wildlife Conservation Society
Non-melanistic 493	Carmelita Afisap, Guatemala	17,4805	-90,1603	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	2004	Wildlife Conservation Society
Non-melanistic 494	Carmelita Afisap, Guatemala	17,5164	-90,1426	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	2004	Wildlife Conservation Society
Non-melanistic 495	Carmelita Afisap, Guatemala	17,4983	-90,0925	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	2004	Wildlife Conservation Society
Non-melanistic 496	Carmelita Afisap, Guatemala	17,4812	-90,1743	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	2004	Wildlife Conservation Society
Non-melanistic 497	Carmelita Afisap, Guatemala	17,4954	-90,1551	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	2004	Wildlife Conservation Society
Non-melanistic 498	Carmelita Afisap, Guatemala	17,4905	-90,0954	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	2004	Wildlife Conservation Society
Non-melanistic 499	Carmelita Afisap, Guatemala	17,4954	-90,1551	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	2004	Wildlife Conservation Society
Non-melanistic 500	Carmelita Afisap, Guatemala	17,4739	-90,1185	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	2004	Wildlife Conservation Society
Non-melanistic 501	Carmelita Afisap, Guatemala	17,5273	-90,1673	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	2004	Wildlife Conservation Society
Non-melanistic 502	Dos Lagunas, Guatemala	17,6967	-89,5148	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	2004	Wildlife Conservation Society
Non-melanistic 503	Dos Lagunas, Guatemala	17,6967	-89,5148	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	2004	Wildlife Conservation Society
Non-melanistic 504	Dos Lagunas, Guatemala	17,7160	-89,5361	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	2004	Wildlife Conservation Society
Non-melanistic 505	Dos Lagunas, Guatemala	17,7356	-89,5294	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	2004	Wildlife Conservation Society
Non-melanistic 506	Dos Lagunas, Guatemala	17,6812	-89,5242	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	2004	Wildlife Conservation Society
Non-melanistic 507	Dos Lagunas, Guatemala	17,6967	-89,5148	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	2004	Wildlife Conservation Society
Non-melanistic 508	East Mirador Rio Azul National Park, Guatemala	17,7570	-89,3385	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	2009	Wildlife Conservation Society
Non-melanistic 509	East Mirador Rio Azul National Park, Guatemala	17,7725	-89,2766	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	2009	Wildlife Conservation Society
Non-melanistic 510	East Mirador Rio Azul National Park, Guatemala	17,7503	-89,3223	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	2009	Wildlife Conservation Society
Non-melanistic 511	East Mirador Rio Azul National Park, Guatemala	17,7109	-89,4116	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	2009	Wildlife Conservation Society
Non-melanistic 512	East Mirador Rio Azul National Park, Guatemala	17,7725	-89,2766	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	2009	Wildlife Conservation Society
Non-melanistic 513	East Mirador Rio Azul National Park, Guatemala	17,7512	-89,3042	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	2009	Wildlife Conservation Society
Non-melanistic 514	East Mirador Rio Azul National Park, Guatemala	17,7021	-89,2718	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	2009	Wildlife Conservation Society
Non-melanistic 515	East Mirador Rio Azul National Park, Guatemala	17,6993	-89,2347	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	2009	Wildlife Conservation Society
Non-melanistic 516	East Mirador Rio Azul National Park, Guatemala	17,7603	-89,2877	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	2009	Wildlife Conservation Society
Non-melanistic 517	East Mirador Rio Azul National Park, Guatemala	17,7603	-89,2877	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	2009	Wildlife Conservation Society
Non-melanistic 518	East Mirador Rio Azul National Park, Guatemala	17,7725	-89,2766	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	2009	Wildlife Conservation Society
Non-melanistic 519	East Mirador Rio Azul National Park, Guatemala	17,7603	-89,2877	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	2009	Wildlife Conservation Society
Non-melanistic 520	East Mirador Rio Azul National Park, Guatemala	17,7243	-89,2606	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	2009	Wildlife Conservation Society
Non-melanistic 521	East Mirador Rio Azul National Park, Guatemala	17,6993	-89,2347	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	2009	Wildlife Conservation Society
Non-melanistic 522	East Mirador Rio Azul National Park, Guatemala	17,7849	-89,2651	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	2009	Wildlife Conservation Society
Non-melanistic 523	East Mirador Rio Azul National Park, Guatemala	17,7362	-89,3696	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	2009	Wildlife Conservation Society
Non-melanistic 524	East Mirador Rio Azul National Park, Guatemala	17,6993	-89,2347	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	2009	Wildlife Conservation Society
Non-melanistic 525	La Gloria, Lechugal, Guatemala	17,5680	-89,8796	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	2007	Wildlife Conservation Society
Non-melanistic 526	La Gloria, Lechugal, Guatemala	17,5744	-89,8612	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	2007	Wildlife Conservation Society
Non-melanistic 527	La Gloria, Lechugal, Guatemala	17,5886	-89,7382	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	2007	Wildlife Conservation Society
Non-melanistic 528	La Gloria, Lechugal, Guatemala	17,6462	-89,7424	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	2007	Wildlife Conservation Society

Samples	Locality / Country	Deg-WGS84		Biome	Ecoregion	Sample type	Year	Information Source
		Lat	Long					
Non-melanistic 529	La Gloria, Lechugal, Guatemala	17,6295	-89,7453	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	2007	Wildlife Conservation Society
Non-melanistic 530	La Gloria, Lechugal, Guatemala	17,6086	-89,7772	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	2007	Wildlife Conservation Society
Non-melanistic 531	Lachuá National Park, Guatemala	15,8746	-90,6516	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	2008	Panthera
Non-melanistic 532	Laguna Del Tigre National Park, Guatemala	17,3570	-90,3698	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	2009	Wildlife Conservation Society
Non-melanistic 533	Laguna Del Tigre National Park, Guatemala	17,2667	-90,3593	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	2009	Wildlife Conservation Society
Non-melanistic 534	Laguna Del Tigre National Park, Guatemala	17,3032	-90,3634	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	2009	Wildlife Conservation Society
Non-melanistic 535	Laguna Del Tigre National Park, Guatemala	17,3565	-90,3740	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	2009	Wildlife Conservation Society
Non-melanistic 536	Laguna Del Tigre National Park, Guatemala	17,3652	-90,3900	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	2009	Wildlife Conservation Society
Non-melanistic 537	Laguna Del Tigre National Park, Guatemala	17,2914	-90,3439	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	2009	Wildlife Conservation Society
Non-melanistic 538	Laguna Del Tigre National Park, Guatemala	17,3029	-90,3652	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	2009	Wildlife Conservation Society
Non-melanistic 539	Laguna Del Tigre National Park, Guatemala	17,2389	-90,3257	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	2009	Wildlife Conservation Society
Non-melanistic 540	Laguna Del Tigre National Park, Guatemala	17,2835	-90,3652	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	2009	Wildlife Conservation Society
Non-melanistic 541	Libertad, Guatemala	15,2782	-89,5984	Tropical and Subtropical Moist Broadleaf Forest	Central American Atlantic moist forests	Photograph	2004	National Museum of Natural History USA
Non-melanistic 542	Tikal National Park, Guatemala	17,2266	-89,6803	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	2005	Wildlife Conservation Society
Non-melanistic 543	Tikal National Park, Guatemala	17,2266	-89,6803	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	2005	Wildlife Conservation Society
Non-melanistic 544	Tikal National Park, Guatemala	17,2027	-89,6086	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	2005	Wildlife Conservation Society
Non-melanistic 545	Tikal National Park, Guatemala	17,2163	-89,5364	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	2005	Wildlife Conservation Society
Non-melanistic 546	Tikal National Park, Guatemala	17,2266	-89,6803	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	2005	Wildlife Conservation Society
Non-melanistic 547	Tikal National Park, Guatemala	17,2248	-89,6618	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	2005	Wildlife Conservation Society
Non-melanistic 548	Tikal National Park, Guatemala	17,2163	-89,5364	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	2005	Wildlife Conservation Society
Non-melanistic 549	Tikal National Park, Guatemala	17,2247	-89,6622	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	2005	Wildlife Conservation Society
Non-melanistic 550	Tikal National Park, Guatemala	17,2267	-89,6808	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	2005	Wildlife Conservation Society
Non-melanistic 551	Tikal National Park, Guatemala	17,2267	-89,6808	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	2005	Wildlife Conservation Society
Non-melanistic 552	West Mirador Rio Azul National Park, Guatemala	17,2247	-89,6622	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	2009	Wildlife Conservation Society
Non-melanistic 553	West Mirador Rio Azul National Park, Guatemala	17,6531	-89,9410	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	2009	Wildlife Conservation Society
Non-melanistic 554	West Mirador Rio Azul National Park, Guatemala	17,7356	-89,8754	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	2009	Wildlife Conservation Society
Non-melanistic 555	West Mirador Rio Azul National Park, Guatemala	17,7356	-89,8754	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	2009	Wildlife Conservation Society
Non-melanistic 556	West Mirador Rio Azul National Park, Guatemala	17,7195	-89,9081	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	2009	Wildlife Conservation Society
Non-melanistic 557	West Mirador Rio Azul National Park, Guatemala	17,7195	-89,9081	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	2009	Wildlife Conservation Society
Non-melanistic 558	West Mirador Rio Azul National Park, Guatemala	17,6844	-89,9297	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	2009	Wildlife Conservation Society
Non-melanistic 559	West Mirador Rio Azul National Park, Guatemala	17,6678	-89,9009	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	2009	Wildlife Conservation Society
Non-melanistic 560	West Mirador Rio Azul National Park, Guatemala	17,6940	-89,8477	Tropical and Subtropical Moist Broadleaf Forest	Petén-Veracruz moist forests	Photograph	2009	Wildlife Conservation Society
Non-melanistic 561	Central Guiana, French Guyana	3,1871	-53,4867	Tropical and Subtropical Moist Broadleaf Forest	Guianan moist forests	Report	2003	Eizirik et al 2003
Non-melanistic 562	Irocoubo, French Guyana	5,3196	-53,2210	Tropical and Subtropical Moist Broadleaf Forest	Guianan moist forests	Photograph	2007	Kwata Association
Non-melanistic 563	Irocoubo, French Guyana	5,3196	-53,2210	Tropical and Subtropical Moist Broadleaf Forest	Guianan moist forests	Photograph	2008	Kwata Association
Non-melanistic 564	Irocoubo, French Guyana	5,3196	-53,2210	Tropical and Subtropical Moist Broadleaf Forest	Guianan moist forests	Photograph	2008	Kwata Association
Non-melanistic 565	Irocoubo, French Guyana	5,3196	-53,2210	Tropical and Subtropical Moist Broadleaf Forest	Guianan moist forests	Photograph	2007	Kwata Association
Non-melanistic 566	Irocoubo, French Guyana	5,3196	-53,2210	Tropical and Subtropical Moist Broadleaf Forest	Guianan moist forests	Photograph	2008	Kwata Association
Non-melanistic 567	Irocoubo, French Guyana	5,3196	-53,2210	Tropical and Subtropical Moist Broadleaf Forest	Guianan moist forests	Photograph	2008	Kwata Association
Non-melanistic 568	Kaw Mountain, French Guyana	4,5343	-52,2576	Tropical and Subtropical Moist Broadleaf Forest	Guianan moist forests	Photograph	2010	Kwata Association
Non-melanistic 569	Kaw Mountain, French Guyana	4,5343	-52,2576	Tropical and Subtropical Moist Broadleaf Forest	Guianan moist forests	Photograph	2009	Kwata Association
Non-melanistic 570	Kaw Mountain, French Guyana	4,5343	-52,2576	Tropical and Subtropical Moist Broadleaf Forest	Guianan moist forests	Photograph	2009	Kwata Association
Non-melanistic 571	Kaw Mountain, French Guyana	4,5343	-52,2576	Tropical and Subtropical Moist Broadleaf Forest	Guianan moist forests	Photograph	2009	Kwata Association
Non-melanistic 572	Kaw Mountain, French Guyana	4,5343	-52,2576	Tropical and Subtropical Moist Broadleaf Forest	Guianan moist forests	Photograph	2009	Kwata Association
Non-melanistic 573	Kaw Mountain, French Guyana	4,5343	-52,2576	Tropical and Subtropical Moist Broadleaf Forest	Guianan moist forests	Photograph	2009	Kwata Association
Non-melanistic 574	Saint Sabbat, French Guyana	5,3846	-53,5966	Tropical and Subtropical Moist Broadleaf Forest	Guianan moist forests	Photograph	2010	Kwata Association
Non-melanistic 575	Saint Sabbat, French Guyana	5,3846	-53,5966	Tropical and Subtropical Moist Broadleaf Forest	Guianan moist forests	Photograph	2009	Kwata Association
Non-melanistic 576	Karanambu Ranch, Guyana	3,8905	-58,7528	Tropical and Subtropical Moist Broadleaf Forest	Guianan moist forests	Photograph	2011	Panthera
Non-melanistic 577	Karanambu Ranch, Guyana	3,6101	-59,3201	Tropical and Subtropical Moist Broadleaf Forest	Guianan moist forests	Photograph	2011	Panthera
Non-melanistic 578	Rapununi River, Guyana	3,9060	-58,7365	Tropical and Subtropical Moist Broadleaf Forest	Guianan moist forests	Photograph	2011	Panthera
Non-melanistic 579	Rupununi, Upper Takutu Essequibo, Guyana	4,0435	-58,6453	Tropical and Subtropical Moist Broadleaf Forest	Guianan moist forests	Photograph	1965	National Museum of Natural History USA
Non-melanistic 580	Shea, Essequibo River, Guyana	2,8451	-58,9838	Tropical and Subtropical Moist Broadleaf Forest	Guianan moist forests	Photograph	2009	Panthera
Non-melanistic 581	Calakmul Biosphere Reserve, Mexico	18,1260	-89,7928	Tropical and Subtropical Moist Broadleaf Forest	Yucatán moist forests	Photograph	no data	Northern Jaguar Project
Non-melanistic 582	Calakmul Biosphere Reserve, Mexico	19,1811	-89,5456	Tropical and Subtropical Moist Broadleaf Forest	Yucatán moist forests	Photograph	no data	Northern Jaguar Project
Non-melanistic 583	Chiapas, Mexico	16,2124	-91,9870	Tropical and Subtropical Coniferous Forests	Central American pine-oak forests	Photograph	no data	National Museum of Natural History USA
Non-melanistic 584	El Aribabi Conservation Ranch, Mexico	30,8142	-110,5113	Tropical and Subtropical Coniferous Forests	Sierra Madre Occidental pine-oak forests	Photograph	no data	Northern Jaguar Project
Non-melanistic 585	El Aribabi Conservation Ranch, Mexico	30,8393	-110,4664	Tropical and Subtropical Coniferous Forests	Sierra Madre Occidental pine-oak forests	Photograph	2010	Northern Jaguar Project
Non-melanistic 586	Jalisco, Mexico	21,5591	-104,1197	Tropical and Subtropical Coniferous Forests	Sierra Madre Occidental pine-oak forests	Report	2003	Eizirik et al 2003
Non-melanistic 587	La Tuxpena, Champoton, Mexico	28,8180	-106,1671	Desert and Xeric Shrublands	Chihuahuan desert	Photograph	1909	National Museum of Natural History USA
Non-melanistic 588	Los Pavos, Mexico	29,6299	-109,2546	Tropical and Subtropical Dry Broadleaf Forest	Sonoran-Sinaloan transition subtropical dry forest	Photograph	2010	Northern Jaguar Project

Samples	Locality / Country	Deg-WGS84		Biome	Ecoregion	Sample type	Year	Information Source
		Lat	Long					
Non-melanistic 589	Los Pavos, Mexico	29,6299	-109,2546	Tropical and Subtropical Dry Broadleaf Forest	Sonoran-Sinaloan transition subtropical dry forest	Photograph	2010	Northern Jaguar Project
Non-melanistic 590	Los Pavos, Mexico	29,6637	-109,4435	Desert and Xeric Shrublands	Chihuahuan desert	Photograph	2008	Northern Jaguar Project
Non-melanistic 591	Nuevo Leon, Monterrey, Mexico	25,8677	-98,7508	Desert and Xeric Shrublands	Tamaulipan mezquital	Photograph	no data	Northern Jaguar Project
Non-melanistic 592	Oaxaca, Mexico	17,0980	-97,0408	Tropical and Subtropical Coniferous Forests	Sierra Madre del Sur pine-oak forests	Photograph	2009	Figel et al 2009
Non-melanistic 593	Oaxaca, Mexico	16,8519	-97,1496	Tropical and Subtropical Coniferous Forests	Sierra Madre del Sur pine-oak forests	Photograph	2009	Figel et al 2009
Non-melanistic 594	Rancho Caracol Reserve, Mexico	23,9727	-98,2339	Tropical and Subtropical Moist Broadleaf Forest	Veracruz moist forests	Photograph	no data	Ocelot Project
Non-melanistic 595	Rancho Caracol Reserve, Mexico	23,9488	-98,1908	Tropical and Subtropical Moist Broadleaf Forest	Veracruz moist forests	Photograph	no data	Ocelot Project
Non-melanistic 596	Rancho Caracol Reserve, Mexico	23,9488	-98,1908	Tropical and Subtropical Moist Broadleaf Forest	Veracruz moist forests	Photograph	no data	Ocelot Project
Non-melanistic 597	Rancho Caracol Reserve, Mexico	23,9488	-98,1908	Tropical and Subtropical Moist Broadleaf Forest	Veracruz moist forests	Photograph	no data	Ocelot Project
Non-melanistic 598	San Juan De Los Reyes, Mexico	24,4180	-103,0727	Desert and Xeric Shrublands	Meseta Central matorral	Photograph	1939	National Museum of Natural History USA
Non-melanistic 599	San Luis Potosi, Mexico	30,5858	-107,0847	Desert and Xeric Shrublands	Chihuahuan desert	Report	2003	Eizirik et al 2003
Non-melanistic 600	Sian Kaan Biosphere Reserve, Mexico	19,3837	-87,7368	Tropical and Subtropical Moist Broadleaf Forest	Yucatán moist forests	Photograph	2011	Northern Jaguar Project
Non-melanistic 601	Sian Kaan Biosphere Reserve, Mexico	20,1036	-87,5422	Tropical and Subtropical Moist Broadleaf Forest	Yucatán moist forests	Photograph	no data	Panthera
Non-melanistic 602	Sierra Bacatete, Sonora, Mexico	21,7187	-103,9055	Tropical and Subtropical Coniferous Forests	Sierra Madre Occidental pine-oak forests	Photograph	no data	Naturalia Institute
Non-melanistic 603	Sierra Nanchititla, Mexico	24,6875	-107,0237	Tropical and Subtropical Dry Broadleaf Forest	Sinaloan dry forests	Photograph	2006	Vilchis et al 2008
Non-melanistic 604	Sinaloa, Mexico	23,9721	-106,3665	Tropical and Subtropical Dry Broadleaf Forest	Sinaloan dry forests	Photograph	no data	Northern Jaguar Project
Non-melanistic 605	Zubaral, Zacatecas, Mexico	22,8795	-102,3693	Desert and Xeric Shrublands	Central Mexican matorral	Photograph	2008	Northern Jaguar Project
Non-melanistic 606	Departamento Atlantico Sul, Nicaragua	12,9266	-83,9814	Tropical and Subtropical Moist Broadleaf Forest	Central American Atlantic moist forests	Report	2003	Eizirik et al 2003
Non-melanistic 607	Departamento Rio San Juan, Nicaragua	11,4886	-84,5633	Tropical and Subtropical Moist Broadleaf Forest	Isthmian-Atlantic moist forests	Report	2003	Eizirik et al 2003
Non-melanistic 608	Barro Colorado, Chagres National Park, Panama	9,3118	-79,4309	Tropical and Subtropical Moist Broadleaf Forest	Isthmian-Atlantic moist forests	Photograph	2009	Panthera
Non-melanistic 609	Bocas Del Toro, Panama	9,3828	-82,4209	Tropical and Subtropical Moist Broadleaf Forest	Isthmian-Atlantic moist forests	Photograph	2004	National Museum of Natural History USA
Non-melanistic 610	Chepo, Panama	9,1406	-78,9984	Tropical and Subtropical Moist Broadleaf Forest	Isthmian-Atlantic moist forests	Report	2003	Eizirik et al 2003
Non-melanistic 611	Cocobolo Nature Reserve, Panama	7,9302	-78,1327	Tropical and Subtropical Moist Broadleaf Forest	Isthmian-Atlantic moist forests	Photograph	2010	Panthera
Non-melanistic 612	Chaco Biosphere Reserve, Paraguay	-19,5535	-60,4862	Tropical and Subtropical Grasslands, Savannas and Shrublands	Dry Chaco	Photograph	2007	Muñoz et al 2007
Non-melanistic 613	Misiones, Paraguay	-25,8326	-54,8279	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Photograph	2004	Ceiba Argentina
Non-melanistic 614	Morumbi Reserve, Paraguay	-25,9319	-55,3281	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Photograph	2010	McBride 2010
Non-melanistic 615	Peruvian Amazon, Peru	-5,8907	-73,5395	Tropical and Subtropical Moist Broadleaf Forest	Southwest Amazon moist forests	Photograph	2008	Furtado et al 2008
Non-melanistic 616	Peruvian Amazon, Peru	-5,8907	-73,5395	Tropical and Subtropical Moist Broadleaf Forest	Southwest Amazon moist forests	Photograph	no data	World Wild Fund
Non-melanistic 617	Peruvian Amazon, Peru	-1,5894	-75,5625	Tropical and Subtropical Moist Broadleaf Forest	Napo moist forests	Photograph	no data	National Museum of Natural History USA
Non-melanistic 618	Peruvian Amazon, Peru	-1,5894	-75,5625	Tropical and Subtropical Moist Broadleaf Forest	Napo moist forests	Photograph	no data	National Museum of Natural History USA
Non-melanistic 619	Peruvian Amazon, Peru	-1,5894	-75,5625	Tropical and Subtropical Moist Broadleaf Forest	Napo moist forests	Photograph	no data	National Museum of Natural History USA
Non-melanistic 620	Peruvian Amazon, Peru	-1,5894	-75,5625	Tropical and Subtropical Moist Broadleaf Forest	Napo moist forests	Photograph	no data	National Museum of Natural History USA
Non-melanistic 621	Peruvian Amazon, Peru	-1,5760	-75,4727	Tropical and Subtropical Moist Broadleaf Forest	Napo moist forests	Photograph	no data	National Museum of Natural History USA
Non-melanistic 622	Peruvian Amazon, Peru	-1,8311	-75,5367	Tropical and Subtropical Moist Broadleaf Forest	Napo moist forests	Photograph	no data	National Museum of Natural History USA
Non-melanistic 623	Peruvian Amazon, Peru	-1,8311	-75,5367	Tropical and Subtropical Moist Broadleaf Forest	Napo moist forests	Photograph	no data	National Museum of Natural History USA
Non-melanistic 624	Los Amigos Biological Station, Peru	-12,2900	-70,2892	Tropical and Subtropical Moist Broadleaf Forest	Southwest Amazon moist forests	Photograph	no data	World Wild Fund
Non-melanistic 625	Napo Tigre Reserve, Peru	-1,6014	-75,5221	Tropical and Subtropical Moist Broadleaf Forest	Napo moist forests	Photograph	2008	National Museum of Natural History USA
Non-melanistic 626	Central Suriname Nature Reserve, Suriname	3,6483	-56,4445	Tropical and Subtropical Moist Broadleaf Forest	Guianan moist forests	Photograph	no data	World Wild Fund
Non-melanistic 627	Amazonas, Pure River, Venezuela	7,3830	-70,5852	Tropical and Subtropical Dry Broadleaf Forest	Apure-Villavicencio dry forests	Report	1970	Panthera
Non-melanistic 628	Bolivar, Venezuela	5,1771	-62,3517	Tropical and Subtropical Moist Broadleaf Forest	Guianan Highlands moist forests	Capture	2003	Eizirik et al 2003
Non-melanistic 629	Bolivar, Venezuela	4,7072	-63,7452	Tropical and Subtropical Moist Broadleaf Forest	Guianan Highlands moist forests	Capture	2003	Eizirik et al 2003
Non-melanistic 630	Caura Valley, Venezuela	4,6502	-62,0667	Tropical and Subtropical Moist Broadleaf Forest	Guianan Highlands moist forests	Photograph	1905	National Museum of Natural History USA
Non-melanistic 631	Falcon, Venezuela	4,1938	-63,3623	Tropical and Subtropical Moist Broadleaf Forest	Guianan Highlands moist forests	Capture	2003	Eizirik et al 2003
Non-melanistic 632	Falcon, Venezuela	4,2479	-64,0416	Tropical and Subtropical Moist Broadleaf Forest	Guianan Highlands moist forests	Capture	2003	Eizirik et al 2003
Non-melanistic 633	Rubio, Venezuela	7,7081	-72,3909	Tropical and Subtropical Moist Broadleaf Forest	Cordillera Oriental montane forests	Report	1998	Panthera
Non-melanistic 634	Uatumã Biological Reserve, Amazonas, Brazil	-4,9311	-66,5212	Tropical and Subtropical Moist Broadleaf Forest	Juruá-Purus moist forests	Photograph	2013	Mastozoological Network Brazil
Non-melanistic 635	Madidi National Park, Bolivia	-13,1374	-68,5371	Tropical and Subtropical Moist Broadleaf Forest	Southwest Amazon moist forests	Photograph	2011	Wildlife Conservation Society
Non-melanistic 636	Madidi National Park, Bolivia	-13,2182	-68,6993	Tropical and Subtropical Moist Broadleaf Forest	Southwest Amazon moist forests	Photograph	2011	Wildlife Conservation Society
Non-melanistic 637	Madidi National Park, Bolivia	-13,2379	-68,4309	Tropical and Subtropical Moist Broadleaf Forest	Southwest Amazon moist forests	Photograph	2011	Wildlife Conservation Society
Non-melanistic 638	Madidi National Park, Bolivia	-13,2765	-68,5373	Tropical and Subtropical Moist Broadleaf Forest	Southwest Amazon moist forests	Photograph	2011	Wildlife Conservation Society
Non-melanistic 639	Madidi National Park, Bolivia	-13,2802	-68,6125	Tropical and Subtropical Moist Broadleaf Forest	Southwest Amazon moist forests	Photograph	2011	Wildlife Conservation Society
Non-melanistic 640	Madidi National Park, Bolivia	-13,3812	-68,5980	Tropical and Subtropical Moist Broadleaf Forest	Southwest Amazon moist forests	Photograph	2011	Wildlife Conservation Society
Non-melanistic 641	Madidi National Park, Bolivia	-13,4580	-68,7463	Tropical and Subtropical Moist Broadleaf Forest	Southwest Amazon moist forests	Photograph	2011	Wildlife Conservation Society
Non-melanistic 642	Cerro Blanco Forest, Ecuador	-2,0237	-80,0365	Tropical and Subtropical Moist Broadleaf Forest	Western Ecuador moist forests	Photograph	2008	Pro Forest Foundation
Non-melanistic 643	Cerro Blanco Forest, Ecuador	-2,0334	-80,0183	Tropical and Subtropical Moist Broadleaf Forest	Western Ecuador moist forests	Photograph	2011	Pro Forest Foundation
Non-melanistic 644	Cerro Blanco Forest, Ecuador	-2,0617	-80,0294	Tropical and Subtropical Moist Broadleaf Forest	Western Ecuador moist forests	Photograph	2011	Pro Forest Foundation
Non-melanistic 645	Cerro Blanco Forest, Ecuador	-2,0882	-80,0723	Tropical and Subtropical Moist Broadleaf Forest	Western Ecuador moist forests	Photograph	2011	Pro Forest Foundation
Non-melanistic 646	Santa Rita Mountains, United States	31,8225	-110,7738	Tropical and Subtropical Coniferous Forests	Sierra Madre Occidental pine-oak forests	Photograph	2012	USFWS
Non-melanistic 647	Corumba, Mato Grosso do Sul, Brazil	-19,0609	-57,5832	Tropical and Subtropical Dry Broadleaf Forest	Chiquitano dry forests	Photograph	1913	American Museum of Natural History USA
Non-melanistic 648	Corumba, Mato Grosso do Sul, Brazil	-19,0502	-57,2822	Flooded Grasslands and Savannas	Pantanal	Photograph	1913	American Museum of Natural History USA

Samples	Locality / Country	Deg-WGS84		Biome	Ecoregion	Sample type	Year	Information Source
		Lat	Long					
Non-melanistic 649	Branco River, Flexal, Roraima, Brazil	0,3166	-61,7396	Tropical and Subtropical Moist Broadleaf Forest	Uatuma-Trombetas moist forests	Photograph	1927	American Museum of Natural History USA
Non-melanistic 650	Manaus, Amazonas, Brazil	-2,9511	-60,1803	Tropical and Subtropical Moist Broadleaf Forest	Uatuma-Trombetas moist forests	Photograph	s/ data	American Museum of Natural History USA
Non-melanistic 651	Fazenda Alegre, Paraguay River, Mato Grosso do Sul, Brazil	-18,2515	-57,3981	Flooded Grasslands and Savannas	Pantanal	Photograph	1935	American Museum of Natural History USA
Non-melanistic 652	Fazenda Alegre, Paraguay River, Mato Grosso do Sul, Brazil	-18,3084	-57,3562	Flooded Grasslands and Savannas	Pantanal	Photograph	1935	American Museum of Natural History USA
Non-melanistic 653	Paraná, Brazil	-24,9125	-54,3611	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Photograph	1914	American Museum of Natural History USA
Non-melanistic 654	Paraná, Brazil	-25,2931	-53,8902	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Photograph	1914	American Museum of Natural History USA
Non-melanistic 655	Paraná, Brazil	-24,8356	-54,1806	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Photograph	1914	American Museum of Natural History USA
Non-melanistic 656	Corumba, Mato Grosso do Sul, Brazil	-19,2927	-57,3920	Flooded Grasslands and Savannas	Pantanal	Photograph	s/ data	American Museum of Natural History USA
Non-melanistic 657	Corumba, Mato Grosso do Sul, Brazil	-18,9024	-57,5263	Flooded Grasslands and Savannas	Pantanal	Photograph	s/ data	American Museum of Natural History USA
Non-melanistic 658	Ayapel, Cordoba, Colombia	8,3236	-75,1537	Tropical and Subtropical Moist Broadleaf Forest	Magdalena-Urabá moist forests	Photograph	1950	American Museum of Natural History USA
Non-melanistic 659	Kartabo Point, Cuyuni, Guyana	4,0916	-58,4244	Tropical and Subtropical Moist Broadleaf Forest	Guianan moist forests	Photograph	1919	American Museum of Natural History USA
Non-melanistic 660	Guaymas, Box Canyon, Sonora, Mexico	28,0774	-110,8297	Desert and Xeric Shrublands	Sonoran desert	Photograph	1940	American Museum of Natural History USA
Non-melanistic 661	Yucatan, Mexico	18,8235	-88,8488	Tropical and Subtropical Moist Broadleaf Forest	Yucatán moist forests	Photograph	s/ data	American Museum of Natural History USA
Non-melanistic 662	Yucatan, Mexico	20,4564	-88,9262	Tropical and Subtropical Dry Broadleaf Forest	Yucatán dry forests	Photograph	s/ data	American Museum of Natural History USA
Non-melanistic 663	Yucatan, Mexico	20,6674	-88,4620	Tropical and Subtropical Dry Broadleaf Forest	Yucatán dry forests	Photograph	s/ data	American Museum of Natural History USA
Non-melanistic 664	Yucatan, Mexico	20,6714	-88,9158	Tropical and Subtropical Dry Broadleaf Forest	Yucatán dry forests	Photograph	s/ data	American Museum of Natural History USA
Non-melanistic 665	Nayarit, Mexico	21,8281	-104,8572	Tropical and Subtropical Dry Broadleaf Forest	Sinaloan dry forests	Photograph	1959	American Museum of Natural History USA
Non-melanistic 666	Escuinapa, Sinaloa, Mexico	22,8478	-105,7851	Tropical and Subtropical Dry Broadleaf Forest	Sinaloan dry forests	Photograph	s/ data	American Museum of Natural History USA
Non-melanistic 667	Escuinapa, Sinaloa, Mexico	22,9238	-105,8051	Tropical and Subtropical Dry Broadleaf Forest	Sinaloan dry forests	Photograph	1904	American Museum of Natural History USA
Non-melanistic 668	Escuinapa, Sinaloa, Mexico	22,8924	-105,8241	Tropical and Subtropical Dry Broadleaf Forest	Sinaloan dry forests	Photograph	1904	American Museum of Natural History USA
Non-melanistic 669	Escuinapa, Sinaloa, Mexico	22,9101	-105,7092	Tropical and Subtropical Dry Broadleaf Forest	Sinaloan dry forests	Photograph	1904	American Museum of Natural History USA
Non-melanistic 670	Escuinapa, Sinaloa, Mexico	22,8311	-105,6800	Tropical and Subtropical Dry Broadleaf Forest	Sinaloan dry forests	Photograph	1904	American Museum of Natural History USA
Non-melanistic 671	San Rafael del Norte, Jinotega, Nicaragua	13,2297	-86,0973	Tropical and Subtropical Coniferous Forests	Central American pine-oak forests	Photograph	1909	American Museum of Natural History USA
Non-melanistic 672	San Ramon, Matagalpa, Nicaragua	12,9272	-85,8284	Tropical and Subtropical Coniferous Forests	Central American pine-oak forests	Photograph	1909	American Museum of Natural History USA
Non-melanistic 673	Tapalisa, Panama	8,3466	-81,4756	Tropical and Subtropical Moist Broadleaf Forest	Isthmian-Pacific moist forests	Photograph	1915	American Museum of Natural History USA
Non-melanistic 674	Ucayali River, Loreto, Peru	-9,4804	-73,0929	Tropical and Subtropical Moist Broadleaf Forest	Southwest Amazon moist forests	Photograph	1927	American Museum of Natural History USA
Non-melanistic 675	Aguaytia River, Ucayali, Peru	-9,5719	-72,8371	Tropical and Subtropical Moist Broadleaf Forest	Southwest Amazon moist forests	Photograph	1923	American Museum of Natural History USA
Non-melanistic 676	Iquitos, Maynas, Peru	-3,8385	-72,9119	Tropical and Subtropical Moist Broadleaf Forest	Southwest Amazon moist forests	Photograph	1924	American Museum of Natural History USA
Non-melanistic 677	Iquitos, Maynas, Peru	-3,9971	-73,2851	Tropical and Subtropical Moist Broadleaf Forest	Iquitos varzeá	Photograph	1925	American Museum of Natural History USA
Non-melanistic 678	Iquitos, Maynas, Peru	-3,4269	-73,2271	Tropical and Subtropical Moist Broadleaf Forest	Napo moist forests	Photograph	1926	American Museum of Natural History USA
Non-melanistic 679	Cenepa River, Amazonas, Peru	-4,5240	-78,0630	Tropical and Subtropical Moist Broadleaf Forest	Ucayali moist forests	Photograph	1929	American Museum of Natural History USA
Non-melanistic 680	Iquitos, Maynas, Peru	-3,4394	-72,5120	Tropical and Subtropical Moist Broadleaf Forest	Iquitos varzeá	Photograph	1925	American Museum of Natural History USA
Non-melanistic 681	Iquitos, Maynas, Peru	-3,6262	-73,1969	Tropical and Subtropical Moist Broadleaf Forest	Iquitos varzeá	Photograph	1925	American Museum of Natural History USA
Non-melanistic 682	Napo River, Loreto, Peru	-2,5371	-73,5589	Tropical and Subtropical Moist Broadleaf Forest	Solimões-Japurá moist forests	Photograph	1927	American Museum of Natural History USA
Non-melanistic 683	Iquitos, Maynas, Peru	-3,5645	-73,1331	Tropical and Subtropical Moist Broadleaf Forest	Iquitos varzeá	Photograph	1928	American Museum of Natural History USA
Non-melanistic 684	Iquitos, Maynas, Peru	-3,9550	-72,5671	Tropical and Subtropical Moist Broadleaf Forest	Southwest Amazon moist forests	Photograph	1930	American Museum of Natural History USA
Non-melanistic 685	Lower Ucayali River, Peru	-8,4110	-74,4243	Tropical and Subtropical Moist Broadleaf Forest	Iquitos varzeá	Photograph	s/ data	American Museum of Natural History USA
Non-melanistic 686	Lower Ucayali River, Peru	-8,1001	-74,5307	Tropical and Subtropical Moist Broadleaf Forest	Iquitos varzeá	Photograph	s/ data	American Museum of Natural History USA
Non-melanistic 687	Maranon River, Peru	-4,8513	-76,7074	Tropical and Subtropical Moist Broadleaf Forest	Napo moist forests	Photograph	1927	American Museum of Natural History USA
Non-melanistic 688	Maripa, Sucre, Bolivar, Venezuela	7,4667	-65,1186	Tropical and Subtropical Grasslands, Savannas and Shrublands	Llanos	Photograph	s/ data	American Museum of Natural History USA
Non-melanistic 689	Yariguies National Park, Santander, Colombia	7,7794	-74,0222	Tropical and Subtropical Moist Broadleaf Forest	Magdalena-Urabá moist forests	Photograph	2013	American Museum of Natural History USA
Non-melanistic 690	Iguaçu National Park, Paraná, Brazil	-25,5372	-53,9274	Tropical and Subtropical Moist Broadleaf Forest	Alto Paraná Atlantic forests	Photograph	2013	CENAP ICMBio
Non-melanistic 691	Bananeiras, Amazonas, Brazil	-8,1561	-66,7061	Tropical and Subtropical Moist Broadleaf Forest	Purus-Madeira moist forests	Photograph	2013	British Museum
Non-melanistic 692	Autlan, Mexico	19,9175	-104,5312	Tropical and Subtropical Coniferous Forests	Trans-Mexican Volcanic Belt pine-oak forests	Photograph	2013	American Museum of Natural History USA
Non-melanistic 693	Cusiana River, Colombia	4,8244	-72,6316	Tropical and Subtropical Grasslands, Savannas and Shrublands	Llanos	Photograph	2013	American Museum of Natural History USA
Non-melanistic 694	Cusiana River, Colombia	4,8244	-72,6316	Tropical and Subtropical Grasslands, Savannas and Shrublands	Llanos	Photograph	2013	American Museum of Natural History USA
Non-melanistic 695	Cusiana River, Colombia	4,8244	-72,6316	Tropical and Subtropical Grasslands, Savannas and Shrublands	Llanos	Photograph	2013	American Museum of Natural History USA
Non-melanistic 696	Jeanette Kawas National Park, Honduras	15,8555	-87,6313	Tropical and Subtropical Moist Broadleaf Forest	Central American Atlantic moist forests	Photograph	2013	Castañeda et al 2013
No color 01	Sorriso, Mato Grosso, Brazil	-12,7788	-55,9314	No data - Maxent Control Model	No data - Maxent Control Model	Database	2013	Global Biodiversity Information Facility - MACN
No color 02	Descalvado, Mato Grosso, Brazil	-16,7500	-57,7000	No data - Maxent Control Model	No data - Maxent Control Model	Database	2013	Global Biodiversity Information Facility - FMNH
No color 03	Pocone, Mato Grosso, Brazil	-16,0666	-56,6304	No data - Maxent Control Model	No data - Maxent Control Model	Database	2013	Global Biodiversity Information Facility - MSU
No color 04	Dardanelos, Bolivia	-10,7670	-66,7330	No data - Maxent Control Model	No data - Maxent Control Model	Database	2013	Global Biodiversity Information Facility - CI
No color 05	Chimore, Bolivia	-17,0000	-65,0000	No data - Maxent Control Model	No data - Maxent Control Model	Database	2013	Global Biodiversity Information Facility - FMNH
No color 06	Tambopata River, Peru	-12,8380	-69,2949	No data - Maxent Control Model	No data - Maxent Control Model	Database	2013	Global Biodiversity Information Facility - CI
No color 07	Puerto Pardo, Peru	-12,5170	-68,6990	No data - Maxent Control Model	No data - Maxent Control Model	Database	2013	Global Biodiversity Information Facility - CI
No color 08	Platanal, Venezuela	1,9166	-64,0785	No data - Maxent Control Model	No data - Maxent Control Model	Database	2013	Global Biodiversity Information Facility - MVZ
No color 09	Balbina, Amazonas, Brazil	-3,0000	-68,0000	No data - Maxent Control Model	No data - Maxent Control Model	Database	2013	Global Biodiversity Information Facility - NRM
No color 10	Puerto Resistencia, Peru	-3,3330	-74,5830	No data - Maxent Control Model	No data - Maxent Control Model	Database	2013	Global Biodiversity Information Facility - FMNH
No color 11	Jutica, Amazonas, Brazil	-3,7666	-64,3769	No data - Maxent Control Model	No data - Maxent Control Model	Database	2013	Global Biodiversity Information Facility - FMNH
No color 12	Santiago River, Ecuador	-3,4830	-78,2330	No data - Maxent Control Model	No data - Maxent Control Model	Database	2013	Global Biodiversity Information Facility - CI

Samples	Locality / Country	Deg-WGS84		Biome	Ecoregion	Sample type	Year	Information Source
		Lat	Long					
No color 13	Rosa Zarate, Ecuador	0,2755	-79,6126	No data - Maxent Control Model	No data - Maxent Control Model	Database	2013	Global Biodiversity Information Facility - MSU
No color 14	Xingu River, Pará, Brazil	-5,4965	-52,7073	No data - Maxent Control Model	No data - Maxent Control Model	Database	2013	Global Biodiversity Information Facility - MSU
No color 15	Manaus, Amazonas, Brazil	-2,5000	-60,0000	No data - Maxent Control Model	No data - Maxent Control Model	Database	2013	Global Biodiversity Information Facility - PBDB
No color 16	Belém, Pará, Brazil	-1,4500	-48,4833	No data - Maxent Control Model	No data - Maxent Control Model	Database	2013	Global Biodiversity Information Facility - FMNH
No color 17	Santo Antonio, Amazonas, Brazil	-2,2500	-60,7500	No data - Maxent Control Model	No data - Maxent Control Model	Database	2013	Global Biodiversity Information Facility - FMNH
No color 18	Orinoco Valley, Venezuela	3,6500	-65,7699	No data - Maxent Control Model	No data - Maxent Control Model	Database	2013	Global Biodiversity Information Facility - NMNH
No color 19	Essequibo River, Guyana	3,2500	-59,2500	No data - Maxent Control Model	No data - Maxent Control Model	Database	2013	Global Biodiversity Information Facility - CI
No color 20	Essequibo River, Guyana	3,2679	-58,7789	No data - Maxent Control Model	No data - Maxent Control Model	Database	2013	Global Biodiversity Information Facility - CI
No color 21	Tapanahoni River, Suriname	4,2699	-54,7379	No data - Maxent Control Model	No data - Maxent Control Model	Database	2013	Global Biodiversity Information Facility - CI
No color 22	Georgetown, Guyana	6,8000	-58,1666	No data - Maxent Control Model	No data - Maxent Control Model	Database	2013	Global Biodiversity Information Facility - FMNH
No color 23	Ranchos Viejos, Venezuela	7,0000	-62,2500	No data - Maxent Control Model	No data - Maxent Control Model	Database	2013	Global Biodiversity Information Facility - NMNH
No color 24	Villa Montes, Bolivia	-20,9666	-62,8499	No data - Maxent Control Model	No data - Maxent Control Model	Database	2013	Global Biodiversity Information Facility - LACM
No color 25	Macaya, Colombia	0,5333	-75,0999	No data - Maxent Control Model	No data - Maxent Control Model	Database	2013	Global Biodiversity Information Facility - FMNH
No color 26	Emiliano Zapata, Mexico	17,5090	-91,9810	No data - Maxent Control Model	No data - Maxent Control Model	Database	2013	Global Biodiversity Information Facility - NMNH
No color 27	San Clemente, Mexico	16,2750	-93,7259	No data - Maxent Control Model	No data - Maxent Control Model	Database	2013	Global Biodiversity Information Facility - MZTG
No color 28	Arroyo Seco, Mexico	21,4830	-99,7036	No data - Maxent Control Model	No data - Maxent Control Model	Database	2013	Global Biodiversity Information Facility - CNMA
No color 29	Upala, Costa Rica	10,9600	-85,0500	No data - Maxent Control Model	No data - Maxent Control Model	Database	2013	Global Biodiversity Information Facility - KUBI

APÊNDICE 2: TABELA SUPLEMENTAR CAPÍTULO 3

Registros *Puma yagouaroundi*

Supplementary table 1 - Location records for *Puma yagouaroundi*.

Samples	Location	Coordinates		Biome	Ecoregion	Sample type	Year	Source
		Latitude	Longitude					
Dark 01	Tarauacá, Acre, Brazil	-8,1909	-70,4363	Tropical and Subtropical Moist Broadleaf Forests	Southwestern Amazonian Moist Forests	Photograph	no data	Accioly Gomes
Dark 02	Manaus, Amazonas, Brazil	-2,3333	-60,0000	Tropical and Subtropical Moist Broadleaf Forests	Uatuma-Trombetas moist forests	Report	no data	Tadeu de Oliveira
Dark 03	Sucundurí River, Amazonas, Brazil	-5,5194	-59,6442	Tropical and Subtropical Moist Broadleaf Forests	Southwestern Amazonian Moist Forests	Photograph	no data	Johnny Jensen
Dark 04	Calçoene, Amapá, Brazil	2,6576	-51,3178	Tropical and Subtropical Moist Broadleaf Forests	Guianan Moist Forests	Report	no data	Micheline Vergara
Dark 05	Vila Velha, Amapá, Brazil	3,2428	-51,2468	Tropical and Subtropical Moist Broadleaf Forests	Guianan Moist Forests	Photograph	2010	Benoit de Thoisy
Dark 06	Andaraí, Bahia, Brazil	-12,8000	-41,3333	Tropical and Subtropical Dry Broadleaf Forests	Atlantic Dry Forests	Report	no data	Tadeu de Oliveira
Dark 07	Barreiras, Bahia, Brazil	-12,0000	-45,0000	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Report	no data	Tadeu de Oliveira
Dark 08	Boqueirão da Onça National Park, Bahia, Brazil	-10,2000	-41,4167	Deserts and Xeric Shrublands	Caatinga	Report	no data	Tadeu de Oliveira
Dark 09	Elisio Medrado, Bahia, Brazil	-12,9333	-39,5167	Tropical and Subtropical Moist Broadleaf Forests	Atlantic Forests	Report	no data	Tadeu de Oliveira
Dark 10	Fazenda Paineiras Gandu, Bahia, Brazil	-13,9532	-39,4606	Tropical and Subtropical Moist Broadleaf Forests	Atlantic Forests	Report	no data	Kevin Flesher
Dark 11	Michelin Igrapiuna Reserve, Bahia, Brazil	-13,8410	-39,1991	Tropical and Subtropical Moist Broadleaf Forests	Atlantic Forests	Report	no data	Kevin Flesher
Dark 12	Potengi, Ceará, Brazil	-7,1369	-39,9345	Deserts and Xeric Shrublands	Caatinga	Report	no data	Tadeu de Oliveira
Dark 13	Potengi, Ceará, Brazil	-7,1369	-39,9345	Deserts and Xeric Shrublands	Caatinga	Report	no data	Tadeu de Oliveira
Dark 14	Quebrada do Pingador, Ceará, Brazil	-4,3000	-38,9833	Tropical and Subtropical Moist Broadleaf Forests	Atlantic Forests	Report	no data	Tadeu de Oliveira
Dark 15	Quebrada do Pingador, Ceará, Brazil	-4,3000	-38,9833	Tropical and Subtropical Moist Broadleaf Forests	Atlantic Forests	Report	no data	Tadeu de Oliveira
Dark 16	Brasília National Park, Brazil	-15,6442	-47,9458	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Photograph	2008	Keila Juarez
Dark 17	Cumari, Goiás, Brazil	-18,2402	-48,1779	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Photograph	no data	Emiliano Ramalho
Dark 18	Bacabeira, Maranhão, Brazil	-2,9667	-44,3000	Tropical and Subtropical Moist Broadleaf Forests	Maranhão Babaçu forests	Report	no data	Tadeu de Oliveira
Dark 19	Barra do Corda, Maranhão, Brazil	-5,3688	-44,9373	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Photograph	2013	Will Mesquita
Dark 20	Mirador State Park, Maranhão, Brazil	-6,6667	-45,3333	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Report	no data	Tadeu de Oliveira
Dark 21	Gurupi Reserve, Maranhão, Brazil	-3,5000	-46,3167	Tropical and Subtropical Moist Broadleaf Forests	Tocantins/Pindare moist forests	Report	no data	Tadeu de Oliveira
Dark 22	Diamantina, Minas Gerais, Brazil	-18,4127	-43,5234	Tropical and Subtropical Moist Broadleaf Forests	Atlantic Forests	Report	2010	Guilherme Ferreira
Dark 23	Martinho Campos, Minas Gerais, Brazil	-19,3293	-45,2428	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Photograph	2009	Fabricio Santos
Dark 24	Rio Doce State Park, Minas Gerais, Brazil	-19,7464	-42,5261	Tropical and Subtropical Moist Broadleaf Forests	Atlantic Forests	Photograph	2007	Leonardo Viana
Dark 25	Rio Preto State Park, Minas Gerais, Brazil	-18,1666	-43,3794	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Photograph	2007	Instituto Biotropicos
Dark 26	Rio Preto State Park, Minas Gerais, Brazil	-18,1666	-43,3794	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Photograph	2007	Instituto Biotropicos
Dark 27	Rio Preto State Park, Minas Gerais, Brazil	-18,1490	-43,3663	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Photograph	2007	Instituto Biotropicos
Dark 28	Rio Preto State Park, Minas Gerais, Brazil	-18,1490	-43,3663	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Photograph	2007	Instituto Biotropicos
Dark 29	Veredas do Peruaçu National Park, Minas Gerais, Brazil	-15,0923	-44,2414	Tropical and Subtropical Dry Broadleaf Forests	Atlantic Dry Forests	Photograph	2007	Instituto Biotropicos
Dark 30	Veredas do Peruaçu National Park, Minas Gerais, Brazil	-15,0842	-44,2663	Tropical and Subtropical Dry Broadleaf Forests	Atlantic Dry Forests	Photograph	2007	Instituto Biotropicos
Dark 31	Veredas do Peruaçu National Park, Minas Gerais, Brazil	-15,0842	-44,2663	Tropical and Subtropical Dry Broadleaf Forests	Atlantic Dry Forests	Photograph	2007	Instituto Biotropicos
Dark 32	Veredas do Peruaçu National Park, Minas Gerais, Brazil	-15,1145	-44,2422	Tropical and Subtropical Dry Broadleaf Forests	Atlantic Dry Forests	Photograph	2007	Instituto Biotropicos
Dark 33	Veredas do Peruaçu National Park, Minas Gerais, Brazil	-15,1145	-44,2422	Tropical and Subtropical Dry Broadleaf Forests	Atlantic Dry Forests	Photograph	2007	Instituto Biotropicos
Dark 34	Veredas do Peruaçu National Park, Minas Gerais, Brazil	-15,1077	-44,2377	Tropical and Subtropical Dry Broadleaf Forests	Atlantic Dry Forests	Photograph	2007	Instituto Biotropicos
Dark 35	Veredas do Peruaçu National Park, Minas Gerais, Brazil	-15,1077	-44,2377	Tropical and Subtropical Dry Broadleaf Forests	Atlantic Dry Forests	Photograph	2007	Instituto Biotropicos
Dark 36	Veredas do Peruaçu National Park, Minas Gerais, Brazil	-15,0923	-44,2414	Tropical and Subtropical Dry Broadleaf Forests	Atlantic Dry Forests	Photograph	2007	Instituto Biotropicos
Dark 37	Veredas do Peruaçu National Park, Minas Gerais, Brazil	-15,0923	-44,2414	Tropical and Subtropical Dry Broadleaf Forests	Atlantic Dry Forests	Photograph	2007	Instituto Biotropicos
Dark 38	Veredas do Peruaçu National Park, Minas Gerais, Brazil	-15,0923	-44,2414	Tropical and Subtropical Dry Broadleaf Forests	Atlantic Dry Forests	Photograph	2007	Instituto Biotropicos
Dark 39	Grande Sertão Veredas National Park, Minas Gerais, Brazil	-15,3004	-45,8202	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Photograph	2006	Instituto Biotropicos
Dark 40	Grande Sertão Veredas National Park, Minas Gerais, Brazil	-15,3004	-45,8202	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Photograph	2006	Instituto Biotropicos
Dark 41	Grande Sertão Veredas National Park, Minas Gerais, Brazil	-15,3004	-45,8202	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Photograph	2006	Instituto Biotropicos
Dark 42	Grande Sertão Veredas National Park, Minas Gerais, Brazil	-15,3004	-45,8202	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Photograph	2006	Instituto Biotropicos
Dark 43	Grande Sertão Veredas National Park, Minas Gerais, Brazil	-15,3004	-45,8202	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Photograph	2006	Instituto Biotropicos
Dark 44	Grande Sertão Veredas National Park, Minas Gerais, Brazil	-15,3004	-45,8202	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Photograph	2006	Instituto Biotropicos
Dark 45	Grande Sertão Veredas National Park, Minas Gerais, Brazil	-15,3004	-45,8202	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Photograph	2006	Instituto Biotropicos
Dark 46	Grande Sertão Veredas National Park, Minas Gerais, Brazil	-15,3004	-45,8202	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Photograph	2006	Instituto Biotropicos
Dark 47	Grande Sertão Veredas National Park, Minas Gerais, Brazil	-15,3004	-45,8202	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Photograph	2006	Instituto Biotropicos
Dark 48	Grande Sertão Veredas National Park, Minas Gerais, Brazil	-15,2821	-45,8178	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Photograph	2006	Instituto Biotropicos
Dark 49	Grande Sertão Veredas National Park, Minas Gerais, Brazil	-15,2913	-45,8195	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Photograph	2006	Instituto Biotropicos
Dark 50	Grande Sertão Veredas National Park, Minas Gerais, Brazil	-15,3628	-45,8288	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Photograph	2006	Instituto Biotropicos
Dark 51	Grande Sertão Veredas National Park, Minas Gerais, Brazil	-15,3628	-45,8288	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Photograph	2006	Instituto Biotropicos
Dark 52	Serro, Minas Gerais, Brazil	-18,5599	-43,4180	Tropical and Subtropical Moist Broadleaf Forests	Atlantic Forests	Report	2010	Guilherme Ferreira
Dark 53	Embiara, Mato Grosso Do Sul, Brazil	-19,8020	-56,3775	Flooded Grasslands and Savannas	Pantanal	Photograph	2013	Embiara Lodge
Dark 54	Fazenda Baía das Pedras, Pantanal da Nhecolândia, Mato Grosso Do Sul, Brazil	-19,3083	-55,7628	Flooded Grasslands and Savannas	Pantanal	Photograph	2011	Patricia Medici
Dark 55	Fazenda Baía das Pedras, Pantanal da Nhecolândia, Mato Grosso Do Sul, Brazil	-19,3083	-55,7628	Flooded Grasslands and Savannas	Pantanal	Photograph	2011	Patricia Medici
Dark 56	Fazenda Nossa Senhora do Carmo, Abobral, Mato Grosso Do Sul, Brazil	-19,4768	-56,9382	Flooded Grasslands and Savannas	Pantanal	Photograph	2009	Patricia Medici
Dark 57	Fazenda São Bento, Pantanal, Mato Grosso Do Sul, Brazil	-17,3229	-56,7354	Flooded Grasslands and Savannas	Pantanal	Photograph	no data	Fernando Tortatto
Dark 58	Fazenda São Bento, Pantanal, Mato Grosso Do Sul, Brazil	-17,3188	-56,7286	Flooded Grasslands and Savannas	Pantanal	Photograph	no data	Fernando Tortatto
Dark 59	Fazenda São Bento, Pantanal, Mato Grosso Do Sul, Brazil	-17,3295	-56,7261	Flooded Grasslands and Savannas	Pantanal	Photograph	no data	Fernando Tortatto

Samples	Location	Coordinates		Biome	Ecoregion	Sample type	Year	Source
		Latitude	Longitude					
Dark 60	Itaporã, Mato Grosso Do Sul, Brazil	-22,0705	-54,9103	Tropical and Subtropical Moist Broadleaf Forests	Alto Paraná Atlantic forests	Photograph	2010	Carnivoros do Iguaçu
Dark 61	Joselândia, Mato Grosso, Brazil	-16,6573	-56,2276	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Photograph	2010	Carlos Benhur Kasper
Dark 62	Joselândia, Mato Grosso, Brazil	-16,6730	-56,2837	Flooded Grasslands and Savannas	Pantanal	Photograph	2010	Carlos Benhur Kasper
Dark 63	Joselândia, Mato Grosso, Brazil	-16,5748	-56,2851	Flooded Grasslands and Savannas	Pantanal	Photograph	2010	Carlos Benhur Kasper
Dark 64	Joselândia, Mato Grosso, Brazil	-16,7036	-56,1300	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Photograph	2010	Carlos Benhur Kasper
Dark 65	Joselândia, Mato Grosso, Brazil	-16,6891	-56,1519	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Photograph	2010	Carlos Benhur Kasper
Dark 66	Joselândia, Mato Grosso, Brazil	-16,6768	-56,1369	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Photograph	2010	Carlos Benhur Kasper
Dark 67	Porto Feliz, Mato Grosso, Brazil	-12,6454	-58,3957	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Photograph	no data	Carlos Benhur Kasper
Dark 68	Tesouro, Mato Grosso, Brazil	-16,0771	-53,5914	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Report	2008	Felipe Gomes
Dark 69	Marabá, Pará, Brazil	-5,3500	-49,0003	Tropical and Subtropical Moist Broadleaf Forests	Xingu-Tocantins-Araguaia moist forests	Photograph	no data	Tadeu de Oliveira
Dark 70	Fazenda Tamanduá, Paraíba, Brazil	-7,0167	-37,3833	Deserts and Xeric Shrublands	Caatinga	Report	no data	Tadeu de Oliveira
Dark 71	Mataraca, Paraíba, Brazil	-6,6566	-35,0808	Tropical and Subtropical Moist Broadleaf Forests	Atlantic Forests	Report	2012	Sertão Bio
Dark 72	Mataraca, Paraíba, Brazil	-6,6754	-35,0452	Tropical and Subtropical Moist Broadleaf Forests	Atlantic Forests	Report	2012	Sertão Bio
Dark 73	Patos, Paraíba, Brazil	-6,9306	-37,2181	Deserts and Xeric Shrublands	Caatinga	Report	2013	Tadeu de Oliveira
Dark 74	Patos, Paraíba, Brazil	-6,9425	-37,2233	Deserts and Xeric Shrublands	Caatinga	Report	2013	Tadeu de Oliveira
Dark 75	Patos, Paraíba, Brazil	-7,0644	-37,0876	Deserts and Xeric Shrublands	Caatinga	Photograph	no data	Tadeu de Oliveira
Dark 76	Sertão Pajeu, Pernambuco, Brazil	-7,8013	-37,9578	Deserts and Xeric Shrublands	Caatinga	Report	2010	Iran de Souza
Dark 77	Guaratuba Protected Area, Paraná, Brazil	-25,7860	-48,6977	Tropical and Subtropical Moist Broadleaf Forests	Serra do Mar coastal forests	Report	2010	Marcelo Mazzoli
Dark 78	Iguaçu National Park, Paraná, Brazil	-25,6354	-54,4532	Tropical and Subtropical Moist Broadleaf Forests	Alto Paraná Atlantic forests	Photograph	1994	Peter Crawshaw Jr.
Dark 79	Iguaçu National Park, Paraná, Brazil	-25,6303	-54,4019	Tropical and Subtropical Moist Broadleaf Forests	Alto Paraná Atlantic forests	Photograph	1993	Peter Crawshaw Jr.
Dark 80	Iguaçu National Park, Paraná, Brazil	-25,2566	-53,7342	Tropical and Subtropical Moist Broadleaf Forests	Alto Paraná Atlantic forests	Photograph	no data	Carnivoros do Iguaçu
Dark 81	Iguaçu National Park, Paraná, Brazil	-25,2566	-53,7342	Tropical and Subtropical Moist Broadleaf Forests	Alto Paraná Atlantic forests	Photograph	2010	Carnivoros do Iguaçu
Dark 82	Iguaçu National Park, Paraná, Brazil	-25,3129	-53,7717	Tropical and Subtropical Moist Broadleaf Forests	Alto Paraná Atlantic forests	Photograph	2010	Carnivoros do Iguaçu
Dark 83	Iguaçu National Park, Paraná, Brazil	-25,5695	-54,2684	Tropical and Subtropical Moist Broadleaf Forests	Alto Paraná Atlantic forests	Photograph	2010	Carnivoros do Iguaçu
Dark 84	Iguaçu National Park, Paraná, Brazil	-25,5786	-54,4311	Tropical and Subtropical Moist Broadleaf Forests	Alto Paraná Atlantic forests	Photograph	2009	Carnivoros do Iguaçu
Dark 85	Iguaçu National Park, Paraná, Brazil	-25,5786	-54,4311	Tropical and Subtropical Moist Broadleaf Forests	Alto Paraná Atlantic forests	Photograph	2009	Carnivoros do Iguaçu
Dark 86	Iguaçu National Park, Paraná, Brazil	-25,5197	-54,2311	Tropical and Subtropical Moist Broadleaf Forests	Alto Paraná Atlantic forests	Photograph	2009	Carnivoros do Iguaçu
Dark 87	Iguaçu National Park, Paraná, Brazil	-25,5485	-54,3007	Tropical and Subtropical Moist Broadleaf Forests	Alto Paraná Atlantic forests	Photograph	2010	Carnivoros do Iguaçu
Dark 88	Iguaçu National Park, Paraná, Brazil	-25,5485	-54,3007	Tropical and Subtropical Moist Broadleaf Forests	Alto Paraná Atlantic forests	Photograph	2009	Carnivoros do Iguaçu
Dark 89	Iguaçu National Park, Paraná, Brazil	-25,4756	-54,0921	Tropical and Subtropical Moist Broadleaf Forests	Alto Paraná Atlantic forests	Photograph	no data	Carnivoros do Iguaçu
Dark 90	Iguaçu National Park, Paraná, Brazil	-25,5972	-54,5152	Tropical and Subtropical Moist Broadleaf Forests	Alto Paraná Atlantic forests	Photograph	2013	Carnivoros do Iguaçu
Dark 91	Iguaçu National Park, Paraná, Brazil	-25,5972	-54,5152	Tropical and Subtropical Moist Broadleaf Forests	Alto Paraná Atlantic forests	Photograph	no data	Carnivoros do Iguaçu
Dark 92	Saint Hilaire, Paraná, Brazil	-25,6685	-48,5888	Tropical and Subtropical Moist Broadleaf Forests	Serra do Mar coastal forests	Photograph	2013	Projeto Lontra
Dark 93	Arroio do Meio, Rio Grande do Sul, Brazil	-29,3604	-51,9308	Tropical and Subtropical Moist Broadleaf Forests	Alto Paraná Atlantic forests	Report	2010	Carlos Benhur Kasper
Dark 94	Bagé, Rio Grande do Sul, Brazil	-31,2045	-53,8519	Tropical and Subtropical Grasslands, Savannas and Shrublands	Uruguayan savanna	Photograph	2011	Renata Bornholdt
Dark 95	Índios River, Rio Grande do Sul, Brazil	-27,2219	-52,8562	Tropical and Subtropical Moist Broadleaf Forests	Araucaria moist forests	Photograph	2008	Jorge Cherem
Dark 96	Bom Jesus, Rio Grande do Sul, Brazil	-28,6205	-50,3356	Tropical and Subtropical Moist Broadleaf Forests	Araucaria moist forests	Photograph	2010	Carlos Benhur Kasper
Dark 97	Caçapava do Sul, Rio Grande do Sul, Brazil	-30,4370	-53,4976	Tropical and Subtropical Grasslands, Savannas and Shrublands	Uruguayan savanna	Report	no data	Felipe Peters
Dark 98	Caçapava do Sul, Rio Grande do Sul, Brazil	-30,5419	-53,4225	Tropical and Subtropical Grasslands, Savannas and Shrublands	Uruguayan savanna	Report	no data	Felipe Peters
Dark 99	Camaquã, Rio Grande do Sul, Brazil	-30,8797	-51,8180	Tropical and Subtropical Grasslands, Savannas and Shrublands	Uruguayan savanna	Photograph	2013	Giuliano Muller
Dark 100	Cotiporã, Rio Grande do Sul, Brazil	-29,0337	-51,8113	Tropical and Subtropical Moist Broadleaf Forests	Alto Paraná Atlantic forests	Report	no data	Felipe Peters
Dark 101	Cruzeiro do Sul, Rio Grande do Sul, Brazil	-29,4931	-51,9856	Tropical and Subtropical Moist Broadleaf Forests	Alto Paraná Atlantic forests	Report	2010	Carlos Benhur Kasper
Dark 102	Cruzeiro do Sul, Rio Grande do Sul, Brazil	-29,5159	-51,9899	Tropical and Subtropical Moist Broadleaf Forests	Alto Paraná Atlantic forests	Report	2010	Carlos Benhur Kasper
Dark 103	Cruzeiro do Sul, Rio Grande do Sul, Brazil	-29,4857	-52,0297	Tropical and Subtropical Moist Broadleaf Forests	Alto Paraná Atlantic forests	Report	2010	Carlos Benhur Kasper
Dark 104	Cruzeiro, Rio Grande do Sul, Brazil	-29,8333	-51,3333	Tropical and Subtropical Grasslands, Savannas and Shrublands	Uruguayan savanna	Report	no data	Tadeu de Oliveira
Dark 105	Cruzeiro, Rio Grande do Sul, Brazil	-29,8333	-51,3333	Tropical and Subtropical Grasslands, Savannas and Shrublands	Uruguayan savanna	Report	no data	Tadeu de Oliveira
Dark 106	Cruzeiro, Rio Grande do Sul, Brazil	-29,8333	-51,3333	Tropical and Subtropical Grasslands, Savannas and Shrublands	Uruguayan savanna	Report	no data	Tadeu de Oliveira
Dark 107	Cruzeiro, Rio Grande do Sul, Brazil	-29,8333	-51,3333	Tropical and Subtropical Grasslands, Savannas and Shrublands	Uruguayan savanna	Report	no data	Tadeu de Oliveira
Dark 108	Cruzeiro, Rio Grande do Sul, Brazil	-29,8333	-51,3333	Tropical and Subtropical Grasslands, Savannas and Shrublands	Uruguayan savanna	Report	no data	Tadeu de Oliveira
Dark 109	São Francisco de Paula National Forest, Rio Grande do Sul, Brazil	-29,3833	-50,3833	Tropical and Subtropical Moist Broadleaf Forests	Araucaria moist forests	Report	no data	Tadeu de Oliveira
Dark 110	São Francisco de Paula National Forest, Rio Grande do Sul, Brazil	-29,3833	-50,3833	Tropical and Subtropical Moist Broadleaf Forests	Araucaria moist forests	Report	no data	Tadeu de Oliveira
Dark 111	São Francisco de Paula National Forest, Rio Grande do Sul, Brazil	-29,3833	-50,3833	Tropical and Subtropical Moist Broadleaf Forests	Araucaria moist forests	Report	no data	Tadeu de Oliveira
Dark 112	Marques de Souza, Rio Grande do Sul, Brazil	-29,3086	-52,1139	Tropical and Subtropical Moist Broadleaf Forests	Alto Paraná Atlantic forests	Photograph	2013	Lucas Gonçalves da Silva
Dark 113	Morro Reuter, Rio Grande do Sul, Brazil	-29,6036	-51,1222	Tropical and Subtropical Moist Broadleaf Forests	Alto Paraná Atlantic forests	Capture	2008	Flávia Tirelli
Dark 114	Palmeira da Missoes, Rio Grande do Sul, Brazil	-27,8710	-53,3106	Tropical and Subtropical Grasslands, Savannas and Shrublands	Uruguayan savanna	Report	2013	Flávia Tirelli
Dark 115	Turvo State Park, Rio Grande do Sul, Brazil	-27,2416	-53,9884	Tropical and Subtropical Moist Broadleaf Forests	Alto Paraná Atlantic forests	Photograph	2013	Caroline Sartor
Dark 116	Turvo State Park, Rio Grande do Sul, Brazil	-27,1685	-53,8760	Tropical and Subtropical Moist Broadleaf Forests	Alto Paraná Atlantic forests	Photograph	2010	Carlos Benhur Kasper
Dark 117	Turvo State Park, Rio Grande do Sul, Brazil	-27,1876	-53,9072	Tropical and Subtropical Moist Broadleaf Forests	Alto Paraná Atlantic forests	Photograph	2010	Carlos Benhur Kasper
Dark 118	Turvo State Park, Rio Grande do Sul, Brazil	-27,1960	-53,8788	Tropical and Subtropical Moist Broadleaf Forests	Alto Paraná Atlantic forests	Photograph	2010	Carlos Benhur Kasper
Dark 119	Turvo State Park, Rio Grande do Sul, Brazil	-27,1985	-53,8892	Tropical and Subtropical Moist Broadleaf Forests	Alto Paraná Atlantic forests	Photograph	2010	Carlos Benhur Kasper
Dark 120	Passo de Taquara, Feliz, Rio Grande do Sul, Brazil	-29,3573	-51,3625	Tropical and Subtropical Moist Broadleaf Forests	Alto Paraná Atlantic forests	Capture	2004	FZB-RS

Samples	Location	Coordinates		Biome	Ecoregion	Sample type	Year	Source
		Latitude	Longitude					
Dark 121	Pinto Bandeira, Rio Grande do Sul, Brazil	-29,0696	-51,4140	Tropical and Subtropical Moist Broadleaf Forests	Alto Paraná Atlantic forests	Capture	2006	IBAMA
Dark 122	Piratini, Rio Grande do Sul, Brazil	-31,4630	-53,1065	Tropical and Subtropical Grasslands, Savannas and Shrublands	Uruguayan savanna	Report	2010	Carlos Benhur Kasper
Dark 123	Taquara, Rio Grande do Sul, Brazil	-28,5363	-53,7497	Tropical and Subtropical Grasslands, Savannas and Shrublands	Uruguayan savanna	Capture	2004	FZB-RS
Dark 124	Ijuí, Rio Grande do Sul, Brazil	-28,3364	-53,9601	Tropical and Subtropical Moist Broadleaf Forests	Alto Paraná Atlantic forests	Capture	2005	FZB-RS
Dark 125	Restinga Seca, Rio Grande do Sul, Brazil	-29,8100	-53,3886	Tropical and Subtropical Moist Broadleaf Forests	Alto Paraná Atlantic forests	Capture	1999	Everton Behr
Dark 126	Sarandi, Rio Grande do Sul, Brazil	-27,9554	-52,9154	Tropical and Subtropical Moist Broadleaf Forests	Araucaria moist forests	Photograph	no data	Felipe Peters
Dark 127	Seberi, Rio Grande do Sul, Brazil	-27,4960	-53,4340	Tropical and Subtropical Moist Broadleaf Forests	Araucaria moist forests	Report	2010	Carlos Benhur Kasper
Dark 128	Soledade, Rio Grande do Sul, Brazil	-28,7685	-52,5313	Tropical and Subtropical Moist Broadleaf Forests	Alto Paraná Atlantic forests	Report	2010	Carlos Benhur Kasper
Dark 129	Tapes, Rio Grande do Sul, Brazil	-30,6356	-51,5536	Tropical and Subtropical Grasslands, Savannas and Shrublands	Uruguayan savanna	Report	no data	Tadeu de Oliveira
Dark 130	Tapes, Rio Grande do Sul, Brazil	-30,6356	-51,5536	Tropical and Subtropical Grasslands, Savannas and Shrublands	Uruguayan savanna	Report	no data	Tadeu de Oliveira
Dark 131	Taquari, Rio Grande do Sul, Brazil	-29,7942	-51,8721	Tropical and Subtropical Grasslands, Savannas and Shrublands	Uruguayan savanna	Report	2010	Carlos Benhur Kasper
Dark 132	Taquari, Rio Grande do Sul, Brazil	-29,3833	-51,9333	Tropical and Subtropical Moist Broadleaf Forests	Alto Paraná Atlantic forests	Report	no data	Tadeu de Oliveira
Dark 133	Cerrito, Rio Grande do Sul, Brazil	-31,7279	-52,8556	Tropical and Subtropical Grasslands, Savannas and Shrublands	Uruguayan savanna	Capture	2002	FZB-RS
Dark 134	Alfredo Wagner, Santa Catarina, Brazil	-27,6934	-49,3434	Tropical and Subtropical Moist Broadleaf Forests	Araucaria moist forests	Photograph	2007	Rafael Garziera
Dark 135	Bom Jesus, Santa Catarina, Brazil	-26,7253	-52,4070	Tropical and Subtropical Moist Broadleaf Forests	Araucaria moist forests	Photograph	2004	Jorge Cherem
Dark 136	Brunópolis, Santa Catarina, Brazil	-27,3336	-50,8865	Tropical and Subtropical Moist Broadleaf Forests	Araucaria moist forests	Photograph	2005	Jorge Cherem
Dark 137	Campos Novos, Santa Catarina, Brazil	-27,3914	-51,1594	Tropical and Subtropical Moist Broadleaf Forests	Araucaria moist forests	Photograph	2007	Jorge Cherem
Dark 138	Catanduvas, Santa Catarina, Brazil	-27,0349	-51,7214	Tropical and Subtropical Moist Broadleaf Forests	Araucaria moist forests	Photograph	2006	Jorge Cherem
Dark 139	Chapecó, Santa Catarina, Brazil	-27,2148	-52,6651	Tropical and Subtropical Moist Broadleaf Forests	Alto Paraná Atlantic forests	Photograph	2008	Jorge Cherem
Dark 140	Erval Velho, Santa Catarina, Brazil	-27,2866	-51,4271	Tropical and Subtropical Moist Broadleaf Forests	Araucaria moist forests	Photograph	2008	Jorge Cherem
Dark 141	Iporã do Oeste, Santa Catarina, Brazil	-26,7437	-53,5874	Tropical and Subtropical Moist Broadleaf Forests	Alto Paraná Atlantic forests	Photograph	no data	Policia Ambiental SC Brazil
Dark 142	Ipuaçu, Santa Catarina, Brazil	-26,6495	-52,4794	Tropical and Subtropical Moist Broadleaf Forests	Araucaria moist forests	Photograph	no data	Jorge Cherem
Dark 143	Itaiópolis, Santa Catarina, Brazil	-26,3438	-49,8647	Tropical and Subtropical Moist Broadleaf Forests	Araucaria moist forests	Photograph	2013	Germano Woehl
Dark 144	Serra do Tabuleiro State Park, Santa Catarina, Brazil	-27,7838	-48,6464	Tropical and Subtropical Moist Broadleaf Forests	Serra do Mar coastal forests	Report	no data	Marcos Tortatto
Dark 145	Serra do Tabuleiro State Park, Santa Catarina, Brazil	-27,9039	-48,7874	Tropical and Subtropical Moist Broadleaf Forests	Serra do Mar coastal forests	Photograph	no data	Vanessa Kuhnen
Dark 146	Serra do Itajaí State Park, Santa Catarina, Brazil	-27,0659	-49,1767	Tropical and Subtropical Moist Broadleaf Forests	Serra do Mar coastal forests	Photograph	2010	CENAP ICMBio
Dark 147	Serra do Itajaí State Park, Santa Catarina, Brazil	-27,0386	-49,2208	Tropical and Subtropical Moist Broadleaf Forests	Serra do Mar coastal forests	Photograph	2010	CENAP ICMBio
Dark 148	Serra do Itajaí State Park, Santa Catarina, Brazil	-27,0386	-49,2208	Tropical and Subtropical Moist Broadleaf Forests	Serra do Mar coastal forests	Photograph	2010	CENAP ICMBio
Dark 149	Serra do Itajaí State Park, Santa Catarina, Brazil	-27,0648	-49,2093	Tropical and Subtropical Moist Broadleaf Forests	Serra do Mar coastal forests	Photograph	2010	CENAP ICMBio
Dark 150	Ponta Serrada, Santa Catarina, Brazil	-26,9219	-51,8804	Tropical and Subtropical Moist Broadleaf Forests	Araucaria moist forests	Photograph	2006	Jorge Cherem
Dark 151	Reserva Biológica de Aguaí	-28,4933	-49,6269	Tropical and Subtropical Moist Broadleaf Forests	Araucaria moist forests	Photograph	2008	CENAP ICMBio
Dark 152	Sassafras Biological Reserve, Santa Catarina, Brazil	-26,7014	-49,6655	Tropical and Subtropical Moist Broadleaf Forests	Serra do Mar coastal forests	Photograph	no data	Fernando Tortatto
Dark 153	Sassafras Biological Reserve, Santa Catarina, Brazil	-26,6966	-49,6799	Tropical and Subtropical Moist Broadleaf Forests	Serra do Mar coastal forests	Photograph	no data	Fernando Tortatto
Dark 154	Sassafras Biological Reserve, Santa Catarina, Brazil	-26,6966	-49,6799	Tropical and Subtropical Moist Broadleaf Forests	Serra do Mar coastal forests	Photograph	no data	Fernando Tortatto
Dark 155	Sassafras Biological Reserve, Santa Catarina, Brazil	-26,7166	-49,6749	Tropical and Subtropical Moist Broadleaf Forests	Serra do Mar coastal forests	Photograph	no data	Fernando Tortatto
Dark 156	Sassafras Biological Reserve, Santa Catarina, Brazil	-26,6862	-49,6370	Tropical and Subtropical Moist Broadleaf Forests	Serra do Mar coastal forests	Photograph	no data	Fernando Tortatto
Dark 157	São Cristóvão do Sul, Santa Catarina, Brazil	-27,3436	-50,4298	Tropical and Subtropical Moist Broadleaf Forests	Araucaria moist forests	Report	2004	Jorge Cherem
Dark 158	Rio Monte Alegre, Chapecó, Santa Catarina, Brazil	-27,2358	-52,5841	Tropical and Subtropical Moist Broadleaf Forests	Alto Paraná Atlantic forests	Photograph	2009	Jorge Cherem
Dark 159	RPPN Chácara Edith, Santa Catarina, Brazil	-27,1007	-48,8913	Tropical and Subtropical Moist Broadleaf Forests	Serra do Mar coastal forests	Photograph	2010	Carnivoros do Iguaçu
Dark 160	RPPN Chácara Edith, Santa Catarina, Brazil	-27,1007	-48,8913	Tropical and Subtropical Moist Broadleaf Forests	Serra do Mar coastal forests	Photograph	2010	Carnivoros do Iguaçu
Dark 161	RPPN Chácara Edith, Santa Catarina, Brazil	-27,1007	-48,8913	Tropical and Subtropical Moist Broadleaf Forests	Serra do Mar coastal forests	Photograph	2010	Carnivoros do Iguaçu
Dark 162	RPPN Chácara Edith, Santa Catarina, Brazil	-27,1052	-48,8811	Tropical and Subtropical Moist Broadleaf Forests	Serra do Mar coastal forests	Photograph	2010	Carnivoros do Iguaçu
Dark 163	RPPN Chácara Edith, Santa Catarina, Brazil	-27,1052	-48,8811	Tropical and Subtropical Moist Broadleaf Forests	Serra do Mar coastal forests	Photograph	2010	Carnivoros do Iguaçu
Dark 164	RPPN Chácara Edith, Santa Catarina, Brazil	-27,1052	-48,8811	Tropical and Subtropical Moist Broadleaf Forests	Serra do Mar coastal forests	Photograph	2010	Carnivoros do Iguaçu
Dark 165	UHE Quebra Queixo, Ipuaçu, Santa Catarina, Brazil	-26,6637	-52,5492	Tropical and Subtropical Moist Broadleaf Forests	Araucaria moist forests	Photograph	2006	Jorge Cherem
Dark 166	UHE Quebra Queixo, Ipuaçu, Santa Catarina, Brazil	-26,6618	-52,5565	Tropical and Subtropical Moist Broadleaf Forests	Araucaria moist forests	Photograph	2007	Jorge Cherem
Dark 167	Vargem, Santa Catarina, Brazil	-27,5066	-50,9246	Tropical and Subtropical Moist Broadleaf Forests	Araucaria moist forests	Photograph	no data	Jorge Cherem
Dark 168	Vargem Bonita, Santa Catarina, Brazil	-27,0211	-51,7325	Tropical and Subtropical Moist Broadleaf Forests	Araucaria moist forests	Photograph	2009	Jorge Cherem
Dark 169	Xanxerê, Santa Catarina, Brazil	-26,8803	-52,3579	Tropical and Subtropical Moist Broadleaf Forests	Araucaria moist forests	Photograph	no data	Jorge Cherem
Dark 170	Jataí Ecological Park, Mogi Guassu, São Paulo, Brazil	-22,3061	-47,0120	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Photograph	2007	USP
Dark 171	Ipanema National Forest, São Paulo, Brazil	-23,4167	-47,5833	Tropical and Subtropical Moist Broadleaf Forests	Alto Paraná Atlantic forests	Report	no data	Tadeu de Oliveira
Dark 172	Morungaba, São Paulo, Brazil	-22,8974	-46,8144	Tropical and Subtropical Moist Broadleaf Forests	Serra do Mar coastal forests	Photograph	2011	CENAP ICMBio
Dark 173	Serra da Bocaina National Park, São Paulo, Brazil	-23,3333	-44,8333	Tropical and Subtropical Moist Broadleaf Forests	Serra do Mar coastal forests	Report	no data	Tadeu de Oliveira
Dark 174	Petar, São Paulo, Brazil	-24,4167	-48,5000	Tropical and Subtropical Moist Broadleaf Forests	Alto Paraná Atlantic forests	Report	no data	Tadeu de Oliveira
Dark 175	Palmas, Tocantins, Brazil	-10,2052	-48,2363	Tropical and Subtropical Moist Broadleaf Forests	Mato Grosso seasonal forests	Report	2011	Guilherme Trovati
Dark 176	Cantão State Park, Tocantins, Brazil	-10,4333	-49,1833	Tropical and Subtropical Moist Broadleaf Forests	Mato Grosso seasonal forests	Report	no data	Tadeu de Oliveira
Dark 177	Aguaray, Argentina	-22,2666	-63,7332	Tropical and Subtropical Moist Broadleaf Forests	Central Andean Yungas	Photograph	2010	Mario DiBitetti
Dark 178	Aguaray, Argentina	-22,2666	-63,7332	Tropical and Subtropical Moist Broadleaf Forests	Central Andean Yungas	Photograph	2010	Mario DiBitetti
Dark 179	Anhelando Al Toro, Argentina	-25,8209	-54,3272	Tropical and Subtropical Moist Broadleaf Forests	Alto Paraná Atlantic forests	Report	2008	Agustin Paviolo
Dark 180	Arroyo Salvador Mazza, Argentina	-22,0768	-63,9464	Tropical and Subtropical Moist Broadleaf Forests	Central Andean Yungas	Photograph	2010	Mario DiBitetti
Dark 181	Balcanera, Argentina	-25,6821	-61,7900	Tropical and Subtropical Grasslands, Savannas and Shrublands	Dry Chaco	Photograph	no data	Veronica Quiroga

Samples	Location	Coordinates		Biome	Ecoregion	Sample type	Year	Source
		Latitude	Longitude					
Dark 182	Baritu National Park , Argentina	-23,1569	-64,6304	Tropical and Subtropical Moist Broadleaf Forests	Central Andean Yungas	Photograph	no data	Juan Carlos Chebez
Dark 183	Buque, Argentina	-25,7820	-54,3475	Tropical and Subtropical Moist Broadleaf Forests	Alto Paraná Atlantic forests	Report	2008	Agustin Paviolo
Dark 184	Camino, Misiones, Argentina	-25,9818	-54,1139	Tropical and Subtropical Moist Broadleaf Forests	Alto Paraná Atlantic forests	Report	2003	Agustin Paviolo
Dark 185	Cartelato, Argentina	-25,8023	-54,3690	Tropical and Subtropical Moist Broadleaf Forests	Alto Paraná Atlantic forests	Report	2006	Agustin Paviolo
Dark 186	Caulario, Argentina	-23,9182	-65,1363	Tropical and Subtropical Moist Broadleaf Forests	Central Andean Yungas	Photograph	2010	Erika Cuyckens
Dark 187	Chancaní Reserve, Argentina	-31,4518	-65,3221	Tropical and Subtropical Grasslands, Savannas and Shrublands	Dry Chaco	Photograph	no data	Juan Carlos Chebez
Dark 188	Chanchito, Argentina	-25,7216	-54,5646	Tropical and Subtropical Moist Broadleaf Forests	Alto Paraná Atlantic forests	Report	no data	Agustin Paviolo
Dark 189	Copo Aibal, Argentina	-25,6963	-61,7907	Tropical and Subtropical Grasslands, Savannas and Shrublands	Dry Chaco	Photograph	no data	Veronica Quiroga
Dark 190	Copo Tesina, Argentina	-25,7913	-62,0429	Tropical and Subtropical Grasslands, Savannas and Shrublands	Dry Chaco	Photograph	no data	Veronica Quiroga
Dark 191	Cortaderas, Argentina	-22,5436	-64,7525	Tropical and Subtropical Moist Broadleaf Forests	Central Andean Yungas	Photograph	2009	Erika Cuyckens
Dark 192	Cortaderas, Argentina	-22,5436	-64,7525	Tropical and Subtropical Moist Broadleaf Forests	Central Andean Yungas	Photograph	2009	Erika Cuyckens
Dark 193	El Falo, Argentina	-25,7546	-54,3785	Tropical and Subtropical Moist Broadleaf Forests	Alto Paraná Atlantic forests	Report	2008	Agustin Paviolo
Dark 194	El Puro, Argentina	-26,8509	-53,9893	Tropical and Subtropical Moist Broadleaf Forests	Alto Paraná Atlantic forests	Report	2005	Agustin Paviolo
Dark 195	Fanta, Argentina	-25,7191	-54,3026	Tropical and Subtropical Moist Broadleaf Forests	Alto Paraná Atlantic forests	Report	2004	Agustin Paviolo
Dark 196	Fumo Bravo, Argentina	-26,8535	-53,9346	Tropical and Subtropical Moist Broadleaf Forests	Alto Paraná Atlantic forests	Report	2005	Agustin Paviolo
Dark 197	Iasa, Argentina	-25,7705	-54,4373	Tropical and Subtropical Moist Broadleaf Forests	Alto Paraná Atlantic forests	Report	2010	Agustin Paviolo
Dark 198	Katramina, Argentina	-26,9207	-53,9903	Tropical and Subtropical Moist Broadleaf Forests	Alto Paraná Atlantic forests	Report	2005	Agustin Paviolo
Dark 199	Katramina, Argentina	-26,9207	-53,9903	Tropical and Subtropical Moist Broadleaf Forests	Alto Paraná Atlantic forests	Report	2005	Agustin Paviolo
Dark 200	Lauraines, Argentina	-25,9650	-54,2001	Tropical and Subtropical Moist Broadleaf Forests	Alto Paraná Atlantic forests	Report	2008	Agustin Paviolo
Dark 201	Ledesma, Argentina	-23,7482	-64,6675	Tropical and Subtropical Moist Broadleaf Forests	Central Andean Yungas	Photograph	no data	Erika Cuyckens
Dark 202	Leptodon, Argentina	-25,7686	-54,2275	Tropical and Subtropical Moist Broadleaf Forests	Alto Paraná Atlantic forests	Report	2008	Agustin Paviolo
Dark 203	Lihue, Argentina	-37,6712	-65,6450	Temperate Grasslands, Savannas and Shrublands	Low Monte	Report	no data	Javier Pereira
Dark 204	Lihue, Argentina	-37,9503	-65,5500	Temperate Grasslands, Savannas and Shrublands	Low Monte	Photograph	2006	Javier Pereira
Dark 205	Lihue, Argentina	-38,0196	-65,4828	Temperate Grasslands, Savannas and Shrublands	Low Monte	Photograph	2001	Javier Pereira
Dark 206	Luna, Argentina	-25,6861	-54,4159	Tropical and Subtropical Moist Broadleaf Forests	Alto Paraná Atlantic forests	Report	2006	Agustin Paviolo
Dark 207	Matula, Argentina	-25,6814	-54,3493	Tropical and Subtropical Moist Broadleaf Forests	Alto Paraná Atlantic forests	Report	2007	Agustin Paviolo
Dark 208	Misiones, Argentina	-26,4314	-53,8961	Tropical and Subtropical Moist Broadleaf Forests	Araucaria moist forests	Photograph	2013	Proyeto Yaguarete
Dark 209	Misiones, Argentina	-25,7554	-54,4089	Tropical and Subtropical Moist Broadleaf Forests	Alto Paraná Atlantic forests	Photograph	2013	Proyeto Yaguarete
Dark 210	Mora, Argentina	-25,8089	-54,2933	Tropical and Subtropical Moist Broadleaf Forests	Alto Paraná Atlantic forests	Report	2008	Agustin Paviolo
Dark 211	Nacanina, Argentina	-25,8071	-54,2522	Tropical and Subtropical Moist Broadleaf Forests	Alto Paraná Atlantic forests	Report	2006	Agustin Paviolo
Dark 212	Nephila, Argentina	-25,6519	-54,5165	Tropical and Subtropical Moist Broadleaf Forests	Alto Paraná Atlantic forests	Report	2008	Agustin Paviolo
Dark 213	Pasión de Gavillanes, Argentina	-26,8525	-53,9478	Tropical and Subtropical Moist Broadleaf Forests	Alto Paraná Atlantic forests	Report	2005	Agustin Paviolo
Dark 214	Pecari, Argentina	-25,6992	-54,3256	Tropical and Subtropical Moist Broadleaf Forests	Alto Paraná Atlantic forests	Report	2004	Agustin Paviolo
Dark 215	Pecari, Argentina	-25,6992	-54,3256	Tropical and Subtropical Moist Broadleaf Forests	Alto Paraná Atlantic forests	Report	2004	Agustin Paviolo
Dark 216	Pinche de Viuda, Argentina	-26,8539	-54,0155	Tropical and Subtropical Moist Broadleaf Forests	Alto Paraná Atlantic forests	Report	2005	Agustin Paviolo
Dark 217	Pupo, Argentina	-26,9960	-54,0131	Tropical and Subtropical Moist Broadleaf Forests	Alto Paraná Atlantic forests	Report	2005	Agustin Paviolo
Dark 218	Putin, Argentina	-25,6913	-54,3788	Tropical and Subtropical Moist Broadleaf Forests	Alto Paraná Atlantic forests	Report	2004	Agustin Paviolo
Dark 219	Quebrada Honda, Argentina	-22,5800	-64,7529	Tropical and Subtropical Moist Broadleaf Forests	Central Andean Yungas	Photograph	2009	Erika Cuyckens
Dark 220	San Agustin, Argentina	-22,3780	-64,0008	Tropical and Subtropical Moist Broadleaf Forests	Central Andean Yungas	Report	2008	Agustin Paviolo
Dark 221	San Agustin, Argentina	-25,6485	-54,3962	Tropical and Subtropical Moist Broadleaf Forests	Alto Paraná Atlantic forests	Report	2004	Agustin Paviolo
Dark 222	Tartagal, Argentina	-22,3780	-64,0008	Tropical and Subtropical Moist Broadleaf Forests	Central Andean Yungas	Photograph	2010	Mario DiBitetti
Dark 223	Tatu Los Pirpintos, Argentina	-25,9227	-61,7140	Temperate Grasslands, Savannas and Shrublands	Dry Chaco	Photograph	no data	Veronica Quiroga
Dark 224	Tranquera, Argentina	-25,7180	-54,4420	Tropical and Subtropical Moist Broadleaf Forests	Alto Paraná Atlantic forests	Report	2008	Agustin Paviolo
Dark 225	Tranquera, Argentina	-25,7229	-54,4428	Tropical and Subtropical Moist Broadleaf Forests	Alto Paraná Atlantic forests	Report	2004	Agustin Paviolo
Dark 226	Unidos, Argentina	-25,6439	-54,3937	Tropical and Subtropical Moist Broadleaf Forests	Alto Paraná Atlantic forests	Report	2006	Agustin Paviolo
Dark 227	Yagua, Argentina	-25,7049	-54,2875	Tropical and Subtropical Moist Broadleaf Forests	Alto Paraná Atlantic forests	Report	2004	Agustin Paviolo
Dark 228	Mountain Cow, Belize	16,8006	-88,7551	Tropical and Subtropical Moist Broadleaf Forests	Petén-Veracruz moist forests	Report	no data	Tadeu de Oliveira
Dark 229	Madidi National Park, Bolivia	-13,2085	-68,7481	Tropical and Subtropical Moist Broadleaf Forests	Southwest Amazon moist forests	Photograph	no data	Leonardo Maffei
Dark 230	San Miguelito Reserve, Paraguay	-24,0650	-55,7839	Tropical and Subtropical Moist Broadleaf Forests	Alto Paraná Atlantic forests	Report	no data	Arispe et al 2007
Dark 231	Tucavaca, Bolivia	-18,5125	-60,8089	Temperate Grasslands, Savannas and Shrublands	Dry Chaco	Photograph	no data	Leonardo Maffei
Dark 232	Cauca Valley, Suarez, Colombia	3,1121	-76,8349	Tropical and Subtropical Moist Broadleaf Forests	Chocó-Darién Moist Forests	Photograph	2013	Panthera
Dark 233	Colosó, Sucre, Colombia	9,4865	-75,3994	Deserts and Xeric Shrublands	Guajira-Barranquilla xeric scrub	Photograph	no data	Esteban Payan, Panthera
Dark 234	Peche River, Tolima, Colombia	4,1043	-75,1824	Tropical and Subtropical Dry Broadleaf Forests	Magdalena Valley dry forests	Photograph	1986	Esteban Payan, Panthera
Dark 235	Peñas Brancas, Cali, Colombia	3,3560	-76,6653	Tropical and Subtropical Moist Broadleaf Forests	Northern Andean Montane Forests	Photograph	2008	Esteban Payan, Panthera
Dark 236	Reserva Las Unamas, Colombia	6,0740	-75,9419	Tropical and Subtropical Moist Broadleaf Forests	Northern Andean Montane Forests	Photograph	2010	Esteban Payan, Panthera
Dark 237	Rio Bayonero, Colombia	6,8139	-71,4617	Tropical and Subtropical Dry Broadleaf Forests	Apure-Villavicencio dry forests	Photograph	1972	Esteban Payan, Panthera
Dark 238	Riosucio, Colombia	7,4321	-77,0677	Tropical and Subtropical Moist Broadleaf Forests	Chocó-Darién Moist Forests	Photograph	1976	Esteban Payan, Panthera
Dark 239	Tayrona National Park, Colombia	11,2837	-74,1169	Deserts and Xeric Shrublands	Guajira-Barranquilla xeric scrub	Report	1979	Esteban Payan, Panthera
Dark 240	Valle de Aburrá, Colombia	6,3795	-75,4449	Tropical and Subtropical Moist Broadleaf Forests	Northern Andean Montane Forests	Photograph	2012	Juan Ortega
Dark 241	Villavicencio, Colombia	4,1323	-73,5771	Tropical and Subtropical Dry Broadleaf Forests	Apure-Villavicencio dry forests	Photograph	1971	Esteban Payan, Panthera
Dark 242	Zambrano, Colombia	9,7044	-74,8471	Tropical and Subtropical Moist Broadleaf Forests	Chocó-Darién Moist Forests	Photograph	1987	Esteban Payan, Panthera

Samples	Location	Coordinates		Biome	Ecoregion	Sample type	Year	Source
		Latitude	Longitude					
Dark 243	Puerto Quepos, Costa Rica	9,4070	-84,1496	Tropical and Subtropical Moist Broadleaf Forests	Isthmian-Pacific moist forests	Photograph	no data	Leonardo Maffei
Dark 244	Osa Sanctuary Reserve, Costa Rica	8,6487	-83,5670	Tropical and Subtropical Moist Broadleaf Forests	Isthmian-Pacific moist forests	Photograph	no data	Leonardo Maffei
Dark 245	Houarani Ecolodge, Ecuador	-1,2035	-76,0294	Tropical and Subtropical Moist Broadleaf Forests	Napo Moist Forests	Photograph	no data	Leonardo Maffei
Dark 246	Tiputini Biological Station, Ecuador	0,0439	-78,6811	Tropical and Subtropical Moist Broadleaf Forests	Northern Andean Montane Forests	Photograph	no data	Leonardo Maffei
Dark 247	Carmelita, Guatemala	17,5164	-90,1426	Tropical and Subtropical Moist Broadleaf Forests	Petén-Veracruz moist forests	Photograph	2008	Jose Moreira, WCS
Dark 248	Laguna Del Tigre National Park, Guatemala	17,2389	-90,3257	Tropical and Subtropical Moist Broadleaf Forests	Petén-Veracruz moist forests	Photograph	2009	Jose Moreira, WCS
Dark 249	Mirador Rio Azul National Park, Guatemala	17,7253	-89,2873	Tropical and Subtropical Moist Broadleaf Forests	Petén-Veracruz moist forests	Photograph	2009	Jose Moreira, WCS
Dark 250	Nouragues Nature Reserve, Ekeni, French Guyana	4,0492	-52,6867	Tropical and Subtropical Moist Broadleaf Forests	Guianan Moist Forests	Photograph	2009	Benoit de Thoisy
Dark 251	Nouragues Nature Reserve, Ekeni, French Guyana	4,0492	-52,6867	Tropical and Subtropical Moist Broadleaf Forests	Guianan Moist Forests	Photograph	2009	Benoit de Thoisy
Dark 252	Nouragues Nature Reserve, Ekeni, French Guyana	4,0492	-52,6867	Tropical and Subtropical Moist Broadleaf Forests	Guianan Moist Forests	Photograph	2009	Benoit de Thoisy
Dark 253	Nouragues Nature Reserve, Ekeni, French Guyana	4,0492	-52,6867	Tropical and Subtropical Moist Broadleaf Forests	Guianan Moist Forests	Photograph	2009	Benoit de Thoisy
Dark 254	Nouragues Nature Reserve, Ekeni, French Guyana	4,0492	-52,6867	Tropical and Subtropical Moist Broadleaf Forests	Guianan Moist Forests	Photograph	2010	Benoit de Thoisy
Dark 255	Nouragues Nature Reserve, Ekeni, French Guyana	4,0492	-52,6867	Tropical and Subtropical Moist Broadleaf Forests	Guianan Moist Forests	Photograph	2010	Benoit de Thoisy
Dark 256	Shea, Essequibo River, Guyana	2,8605	-58,9478	Tropical and Subtropical Moist Broadleaf Forests	Guianan Moist Forests	Photograph	2009	Rob Pickles
Dark 257	Rancho Caracol Reserve, Mexico	23,9488	-98,1908	Tropical and Subtropical Moist Broadleaf Forests	Veracruz moist forests	Photograph	no data	Ocelot Project
Dark 258	Rancho Caracol Reserve, Mexico	23,9488	-98,1908	Tropical and Subtropical Moist Broadleaf Forests	Veracruz moist forests	Photograph	no data	Ocelot Project
Dark 259	Rancho Caracol Reserve, Mexico	23,9488	-98,1908	Tropical and Subtropical Moist Broadleaf Forests	Veracruz moist forests	Photograph	no data	Ocelot Project
Dark 260	Rancho Caracol Reserve, Mexico	23,9488	-98,1908	Tropical and Subtropical Moist Broadleaf Forests	Veracruz moist forests	Photograph	no data	Ocelot Project
Dark 261	Rancho Caracol Reserve, Mexico	23,9488	-98,1908	Tropical and Subtropical Moist Broadleaf Forests	Veracruz moist forests	Photograph	no data	Ocelot Project
Dark 262	Rancho Caracol Reserve, Mexico	23,9488	-98,1908	Tropical and Subtropical Moist Broadleaf Forests	Veracruz moist forests	Photograph	no data	Ocelot Project
Dark 263	Rancho Caracol Reserve, Mexico	23,9488	-98,1908	Tropical and Subtropical Moist Broadleaf Forests	Veracruz moist forests	Photograph	no data	Ocelot Project
Dark 264	Rancho Caracol Reserve, Mexico	23,9727	-98,2339	Tropical and Subtropical Moist Broadleaf Forests	Veracruz moist forests	Photograph	no data	Ocelot Project
Dark 265	Rancho Caracol Reserve, Mexico	23,9727	-98,2339	Tropical and Subtropical Moist Broadleaf Forests	Veracruz moist forests	Photograph	no data	Ocelot Project
Dark 266	Rancho Caracol Reserve, Mexico	23,9727	-98,2339	Tropical and Subtropical Moist Broadleaf Forests	Veracruz moist forests	Photograph	no data	Ocelot Project
Dark 267	San Fernando, Mexico	25,0003	-97,9771	Tropical and Subtropical Grasslands, Savannas and Shrublands	Western Gulf coastal grasslands	Photograph	no data	Michael Tewes
Dark 268	Ciudad del Panama, Panama	9,0784	-80,0856	Tropical and Subtropical Moist Broadleaf Forests	Isthmian-Atlantic moist forests	Photograph	no data	Smithsonian Institution
Dark 269	Estacion Ledesma, Paraguay	-23,7569	-60,3254	Tropical and Subtropical Grasslands, Savannas and Shrublands	Dry Chaco	Photograph	no data	Mario DiBitetti
Dark 270	Estacion Ledesma, Paraguay	-23,6339	-60,4513	Tropical and Subtropical Grasslands, Savannas and Shrublands	Dry Chaco	Photograph	2010	Mario DiBitetti
Dark 271	Amazonia Peruana, Peru	-1,5460	-75,4201	Tropical and Subtropical Moist Broadleaf Forests	Napo Moist Forests	Photograph	2008	Smithsonian Institution
Dark 272	Amazonia Peruana, Peru	-1,5460	-75,4201	Tropical and Subtropical Moist Broadleaf Forests	Napo Moist Forests	Photograph	2008	Smithsonian Institution
Dark 273	Amazonia Peruana, Peru	-1,5460	-75,4201	Tropical and Subtropical Moist Broadleaf Forests	Napo Moist Forests	Photograph	2008	Smithsonian Institution
Dark 274	Los Amigos Biological Reserve, Peru	-12,5453	-70,0904	Tropical and Subtropical Moist Broadleaf Forests	Southwest Amazon moist forests	Photograph	2005	Renata Pitman
Dark 275	Napo Reserve, Peru	-1,6213	-75,4195	Tropical and Subtropical Moist Broadleaf Forests	Napo Moist Forests	Photograph	2008	Smithsonian Institution
Dark 276	Yanchaga-Chemillen National Park, Peru	-10,2275	-75,0852	Tropical and Subtropical Moist Broadleaf Forests	Napo Moist Forests	Photograph	2012	Rodolfo Vasquez
Dark 277	Yanchaga-Chemillen National Park, Peru	-10,2275	-75,0852	Tropical and Subtropical Moist Broadleaf Forests	Napo Moist Forests	Photograph	2012	Rodolfo Vasquez
Dark 278	Yanchaga-Chemillen National Park, Peru	-10,2275	-75,0852	Tropical and Subtropical Moist Broadleaf Forests	Napo Moist Forests	Photograph	2012	Rodolfo Vasquez
Dark 279	San Pablo, Peru	-11,3500	-73,1800	Tropical and Subtropical Moist Broadleaf Forests	Southwest Amazon moist forests	Photograph	2009	Esteban Payan, Panthera
Dark 280	Santa Fé, Rio Salado, Argentina	-29,1606	-58,6854	Tropical and Subtropical Grasslands, Savannas and Shrublands	Humid Chaco	Photograph	1974	Smithsonian Institution
Dark 281	Carandayti, Luis Calvo, Chuquisaca, Bolivia	-19,6612	-63,0433	Tropical and Subtropical Grasslands, Savannas and Shrublands	Dry Chaco	Photograph	s/ data	American Museum of Natural History
Dark 282	Mamore, Beni, Bolivia	-15,0867	-64,8684	Tropical and Subtropical Grasslands, Savannas and Shrublands	Beni savanna	Photograph	1966	American Museum of Natural History
Dark 283	Mamore, Beni, Bolivia	-15,1715	-64,9267	Tropical and Subtropical Grasslands, Savannas and Shrublands	Beni savanna	Photograph	1966	American Museum of Natural History
Dark 284	Anapolis, Goias, Brazil	-16,2662	-48,9818	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Photograph	1937	American Museum of Natural History
Dark 285	Anapolis, Goias, Brazil	-16,2869	-48,9912	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Photograph	1937	American Museum of Natural History
Dark 286	Bagé, Rio Grande do Sul, Brazil	-31,2994	-54,0447	Tropical and Subtropical Grasslands, Savannas and Shrublands	Uruguayan savanna	Photograph	no data	Lucas Gonçalves da Silva
Dark 287	Cachoeira Porteira, Trombetas River, Oriximiná, Brazil	-1,1598	-56,9912	Tropical and Subtropical Moist Broadleaf Forests	Uatuma-Trombetas moist forests	Photograph	1977	Tiago Freitas, MPEG
Dark 288	Campos Novos, Santa Catarina, Brazil	-27,3939	-51,1846	Tropical and Subtropical Moist Broadleaf Forests	Araucaria moist forests	Photograph	2010	Jorge Cherem
Dark 289	Colônia Inglês de Souza, Monte Alegre, Brazil	-1,9095	-54,0950	Tropical and Subtropical Moist Broadleaf Forests	Uatuma-Trombetas moist forests	Photograph	1912	Tiago Freitas, MPEG
Dark 290	Corumba, Mato Grosso do Sul, Brazil	-19,0586	-57,7065	Tropical and Subtropical Dry Broadleaf Forests	Chiquitano Dry Forests	Photograph	s/ data	American Museum of Natural History
Dark 291	Fontoura Xavier, Rio Grande do Sul, Brazil	-29,1794	-52,6356	Tropical and Subtropical Moist Broadleaf Forests	Alto Paraná Atlantic forests	Photograph	1988	Tiago Freitas, MPEG
Dark 292	Fordlândia, Pará, Brazil	-3,8000	-55,4833	Tropical and Subtropical Moist Broadleaf Forests	Madeira-Tapajós moist forests	Report	no data	Tadeu de Oliveira
Dark 293	Ipixuna, Pará, Brazil	-4,9192	-49,1607	Tropical and Subtropical Moist Broadleaf Forests	Tocantins/Pindare moist forests	Photograph	2005	Tiago Freitas, MPEG
Dark 294	Moji dos Campos, Pará, Brazil	-2,5000	-54,5000	Tropical and Subtropical Moist Broadleaf Forests	Tapajós-Xingu moist forests	Report	no data	Tadeu de Oliveira
Dark 295	Mojui dos Campos, Santarém, Pará, Brazil	-2,4508	-54,7589	Tropical and Subtropical Moist Broadleaf Forests	Tapajós-Xingu moist forests	Photograph	1975	Smithsonian Institution
Dark 296	Palmas, Tocantins, Brazil	-9,9500	-48,3333	Tropical and Subtropical Moist Broadleaf Forests	Mato Grosso seasonal forests	Photograph	no data	Tadeu de Oliveira
Dark 297	Palmas, Tocantins, Brazil	-9,9500	-48,3333	Tropical and Subtropical Moist Broadleaf Forests	Mato Grosso seasonal forests	Photograph	no data	Tadeu de Oliveira
Dark 298	Palmas, Tocantins, Brazil	-9,9500	-48,3333	Tropical and Subtropical Moist Broadleaf Forests	Mato Grosso seasonal forests	Photograph	no data	Tadeu de Oliveira
Dark 299	Palmas, Tocantins, Brazil	-9,9500	-48,3333	Tropical and Subtropical Moist Broadleaf Forests	Mato Grosso seasonal forests	Photograph	no data	Tadeu de Oliveira
Dark 300	Porto Artur, Brazil	-12,8279	-54,4015	Tropical and Subtropical Moist Broadleaf Forests	Mato Grosso seasonal forests	Photograph	no data	Tadeu de Oliveira
Dark 301	Rio das Garças, Brazil	-16,0667	-53,5500	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Photograph	no data	Tadeu de Oliveira
Dark 302	Touros River, Bom Jesus, Rio Grande do Sul, Brazil	-28,6404	-50,2865	Tropical and Subtropical Moist Broadleaf Forests	Araucaria moist forests	Photograph	1987	Jorge Cherem
Dark 303	Gurupizinho, Paragominas, Pará, Brazil	-3,0540	-47,2817	Tropical and Subtropical Moist Broadleaf Forests	Tocantins/Pindare moist forests	Photograph	1983	Tiago Freitas, MPEG

Samples	Location	Coordinates		Biome	Ecoregion	Sample type	Year	Source
		Latitude	Longitude					
Dark 304	Tapajos River, Santarem, Pará, Brazil	-2,5529	-54,8954	Tropical and Subtropical Moist Broadleaf Forests	Tapajós-Xingu moist forests	Photograph	1901	American Museum of Natural History
Dark 305	Tuparana Lake, Espirito Santo, Brazil	-20,3799	-41,6964	Tropical and Subtropical Moist Broadleaf Forests	Atlantic Forests	Photograph	1929	American Museum of Natural History
Dark 306	Bogota, Cundinamarca, Colombia	4,5500	-74,0393	Tropical and Subtropical Moist Broadleaf Forests	Northern Andean Montane Forests	Photograph	s/ data	American Museum of Natural History
Dark 307	Bonda, Colombia	11,2339	-74,0712	Deserts and Xeric Shrublands	Guajira-Barranquilla xeric scrub	Photograph	1899	American Museum of Natural History
Dark 308	Popayan, Cauca, Colombia	2,4542	-76,5924	Tropical and Subtropical Moist Broadleaf Forests	Northern Andean Montane Forests	Photograph	1911	American Museum of Natural History
Dark 309	Sabana Larga, Cienaga de Guajaro, Atlantico, Colombia	9,4908	-74,8624	Tropical and Subtropical Moist Broadleaf Forests	Magdalena-Urabá moist forests	Photograph	1941	Smithsonian Institution
Dark 310	Sabana Larga, Cienaga de Guajaro, Atlantico, Colombia	9,9283	-74,9150	Tropical and Subtropical Moist Broadleaf Forests	Magdalena-Urabá moist forests	Photograph	1941	Smithsonian Institution
Dark 311	Santa Marta, Magdalena, Colombia	11,1724	-74,1188	Deserts and Xeric Shrublands	Guajira-Barranquilla xeric scrub	Photograph	1901	American Museum of Natural History
Dark 312	Timbio, Cauca, Colombia	2,3511	-76,6574	Tropical and Subtropical Moist Broadleaf Forests	Northern Andean Montane Forests	Photograph	s/ data	American Museum of Natural History
Dark 313	Timbio, Cauca, Colombia	2,3211	-76,6420	Tropical and Subtropical Moist Broadleaf Forests	Northern Andean Montane Forests	Photograph	s/ data	American Museum of Natural History
Dark 314	Villavicencio, Meta, Colombia	4,1417	-73,6089	Tropical and Subtropical Dry Broadleaf Forests	Apure-Villavicencio dry forests	Photograph	1940	American Museum of Natural History
Dark 315	Puriscal, San Jose, Costa Rica	9,9149	-84,1056	Tropical and Subtropical Moist Broadleaf Forests	Costa Rican seasonal moist forests	Photograph	1941	American Museum of Natural History
Dark 316	Pajan, Ecuador	-1,5750	-80,4161	Tropical and Subtropical Dry Broadleaf Forests	Ecuadorian dry forests	Photograph	1959	American Museum of Natural History
Dark 317	Portovelo, El Oro, Ecuador	-3,7067	-79,6225	Tropical and Subtropical Moist Broadleaf Forests	Northern Andean Montane Forests	Photograph	1920	American Museum of Natural History
Dark 318	Brownsville, Cameron County, Texas, United States	26,1410	-97,4945	Tropical and Subtropical Grasslands, Savannas and Shrublands	Western Gulf coastal grasslands	Photograph	1892	Smithsonian Institution
Dark 319	Brownsville, Texas, United States	25,9167	-97,4833	Tropical and Subtropical Grasslands, Savannas and Shrublands	Western Gulf coastal grasslands	Photograph	no data	Tadeu de Oliveira
Dark 320	Brownsville, Texas, United States	25,9167	-97,4833	Tropical and Subtropical Grasslands, Savannas and Shrublands	Western Gulf coastal grasslands	Photograph	no data	Tadeu de Oliveira
Dark 321	Brownsville, Texas, United States	25,9167	-97,4833	Tropical and Subtropical Grasslands, Savannas and Shrublands	Western Gulf coastal grasslands	Photograph	no data	Tadeu de Oliveira
Dark 322	Brownsville, Texas, United States	25,9167	-97,4833	Tropical and Subtropical Grasslands, Savannas and Shrublands	Western Gulf coastal grasslands	Photograph	no data	Tadeu de Oliveira
Dark 323	La Libertad, Peten, Guatemala	16,8320	-90,1104	Tropical and Subtropical Moist Broadleaf Forests	Petén-Veracruz moist forests	Photograph	1925	Smithsonian Institution
Dark 324	Tiquisate, Escuintla, Guatemala	14,2869	-91,3659	Tropical and Subtropical Dry Broadleaf Forests	Central American dry forests	Photograph	1925	American Museum of Natural History
Dark 325	Kartabo, Guyana	6,7500	-61,0000	Tropical and Subtropical Moist Broadleaf Forests	Guianan Moist Forests	Photograph	no data	Tadeu de Oliveira
Dark 326	Rupununi, Guyana	2,8333	-59,6667	Tropical and Subtropical Grasslands, Savannas and Shrublands	Guianan savanna	Photograph	no data	Tadeu de Oliveira
Dark 327	Cartabo, Cuyuni Mazaruni Region, Guyana	4,0363	-58,6739	Tropical and Subtropical Moist Broadleaf Forests	Guianan Moist Forests	Photograph	1924	American Museum of Natural History
Dark 328	Kartabo Point, Cuyuni, Guyana	5,8844	-58,5062	Tropical and Subtropical Moist Broadleaf Forests	Guianan Moist Forests	Photograph	1920	American Museum of Natural History
Dark 329	Azacualpa, Honduras	15,3219	-88,5585	Tropical and Subtropical Moist Broadleaf Forests	Central American Atlantic moist forests	Photograph	s/ data	American Museum of Natural History
Dark 330	Chamelecon, Cortes, Honduras	15,3702	-88,0454	Tropical and Subtropical Dry Broadleaf Forests	Central American dry forests	Photograph	1901	Smithsonian Institution
Dark 331	Chamelecon, Cortes, Honduras	15,3379	-87,9487	Tropical and Subtropical Dry Broadleaf Forests	Central American dry forests	Photograph	1901	Smithsonian Institution
Dark 332	Chemelicon, Honduras	15,0000	-86,5000	Tropical and Subtropical Dry Broadleaf Forests	Mesoamerican Pine-Oak Forests	Photograph	no data	Tadeu de Oliveira
Dark 333	San Jose, La Paz, Honduras	14,2666	-87,8827	Tropical and Subtropical Dry Broadleaf Forests	Mesoamerican Pine-Oak Forests	Photograph	1937	American Museum of Natural History
Dark 334	Tegucigalpa, La Flor Archaga, Distrito Central, Honduras	14,2076	-87,1911	Tropical and Subtropical Dry Broadleaf Forests	Mesoamerican Pine-Oak Forests	Photograph	s/ data	American Museum of Natural History
Dark 335	Chiapas, Mexico	15,9167	-92,7167	Tropical and Subtropical Dry Broadleaf Forests	Mesoamerican Pine-Oak Forests	Photograph	no data	Tadeu de Oliveira
Dark 336	Colima, Mexico	19,1148	-103,5851	Tropical and Subtropical Dry Broadleaf Forests	Southern Mexican Dry Forests	Photograph	1896	American Museum of Natural History
Dark 337	Colima, Mexico	19,0955	-103,5930	Tropical and Subtropical Dry Broadleaf Forests	Southern Mexican Dry Forests	Photograph	1896	American Museum of Natural History
Dark 338	Escuinapa, Sinaloa, Mexico	22,8595	-105,7678	Tropical and Subtropical Dry Broadleaf Forests	Southern Mexican Dry Forests	Photograph	1904	American Museum of Natural History
Dark 339	Juchitan, Oaxaca, Mexico	16,4163	-94,9837	Tropical and Subtropical Dry Broadleaf Forests	Southern Mexican Dry Forests	Photograph	1962	American Museum of Natural History
Dark 340	Juchitan, Oaxaca, Mexico	16,4610	-95,0215	Tropical and Subtropical Dry Broadleaf Forests	Southern Mexican Dry Forests	Photograph	1962	American Museum of Natural History
Dark 341	Juchitan, Oaxaca, Mexico	16,3855	-95,0068	Tropical and Subtropical Dry Broadleaf Forests	Southern Mexican Dry Forests	Photograph	1962	American Museum of Natural History
Dark 342	La Tuxpena, Champoton, Mexico	26,4612	-102,6866	Deserts and Xeric Shrublands	Chihuahuan-Tehuacán Deserts	Photograph	1912	Smithsonian Institution
Dark 343	La Tuxpena, Champoton, Mexico	19,2349	-90,6027	Tropical and Subtropical Moist Broadleaf Forests	Yucatán moist forests	Report	no data	Tadeu de Oliveira
Dark 344	Salina Garrapatera, Tehuantepec, Mexico	16,1497	-95,3135	Tropical and Subtropical Dry Broadleaf Forests	Southern Mexican Dry Forests	Photograph	1948	American Museum of Natural History
Dark 345	San Antonio, Tehuantepec, Mexico	16,4224	-95,3719	Tropical and Subtropical Dry Broadleaf Forests	Southern Mexican Dry Forests	Photograph	1951	American Museum of Natural History
Dark 346	Santo Domingo Tehuantepec, Oaxaca, Mexico	24,3162	-98,6737	Tropical and Subtropical Moist Broadleaf Forests	Veracruz moist forests	Photograph	1944	American Museum of Natural History
Dark 347	Santo Domingo Tehuantepec, Oaxaca, Mexico	24,3547	-98,6318	Tropical and Subtropical Moist Broadleaf Forests	Veracruz moist forests	Photograph	1944	American Museum of Natural History
Dark 348	Tehuantepec, Oaxaca, Mexico	16,3611	-95,1975	Tropical and Subtropical Dry Broadleaf Forests	Southern Mexican Dry Forests	Photograph	s/ data	American Museum of Natural History
Dark 349	Tehuantepec, Oaxaca, Mexico	16,3765	-95,2151	Tropical and Subtropical Dry Broadleaf Forests	Southern Mexican Dry Forests	Photograph	1958	American Museum of Natural History
Dark 350	Tuxtepec, Oaxaca, Mexico	18,0828	-96,1084	Tropical and Subtropical Moist Broadleaf Forests	Petén-Veracruz moist forests	Photograph	1962	American Museum of Natural History
Dark 351	Cana, Panama	8,7261	-78,5381	Tropical and Subtropical Moist Broadleaf Forests	Isthmian-Atlantic moist forests	Photograph	no data	Tadeu de Oliveira
Dark 352	San Blas, Panama	9,3832	-78,9167	Tropical and Subtropical Moist Broadleaf Forests	Chocó-Darién Moist Forests	Photograph	no data	Tadeu de Oliveira
Dark 353	Villeta, Central, Paraguay	-25,5246	-57,5313	Tropical and Subtropical Grasslands, Savannas and Shrublands	Humid Chaco	Photograph	1944	American Museum of Natural History
Dark 354	Ygatimi, Canindeyu, Paraguay	-24,0736	-55,5555	Tropical and Subtropical Moist Broadleaf Forests	Alto Paraná Atlantic forests	Photograph	1947	American Museum of Natural History
Dark 355	Coronel Portillo, Ucayali, Peru	-9,0382	-73,6469	Tropical and Subtropical Moist Broadleaf Forests	Southwestern Amazonian Moist Forests	Photograph	s/ data	American Museum of Natural History
Dark 356	Iquitos, Maynas, Peru	-3,7718	-73,2057	Tropical and Subtropical Moist Broadleaf Forests	Amazon River and Flooded Forests	Photograph	1924	American Museum of Natural History
Dark 357	Iquitos, Maynas, Peru	-3,8148	-73,3258	Tropical and Subtropical Moist Broadleaf Forests	Amazon River and Flooded Forests	Photograph	1924	American Museum of Natural History
Dark 358	Iquitos, Maynas, Peru	-3,5326	-73,1531	Tropical and Subtropical Moist Broadleaf Forests	Amazon River and Flooded Forests	Photograph	1926	American Museum of Natural History
Dark 359	Iquitos, Maynas, Peru	-3,6532	-73,2200	Tropical and Subtropical Moist Broadleaf Forests	Amazon River and Flooded Forests	Photograph	1927	American Museum of Natural History
Dark 360	Pucallpa Wildlife Refuge, Peru	-8,3702	-74,4692	Tropical and Subtropical Moist Broadleaf Forests	Amazon River and Flooded Forests	Photograph	1942	Smithsonian Institution
Dark 361	Pucalpa, Peru	-8,3833	-74,5167	Tropical and Subtropical Moist Broadleaf Forests	Amazon River and Flooded Forests	Photograph	no data	Tadeu de Oliveira
Dark 362	Itaya River, Peru	-3,5936	-73,3880	Tropical and Subtropical Moist Broadleaf Forests	Amazon River and Flooded Forests	Photograph	1942	Smithsonian Institution
Dark 363	Ucayali River, Peru	-9,7370	-73,1237	Tropical and Subtropical Moist Broadleaf Forests	Southwestern Amazonian Moist Forests	Photograph	1927	American Museum of Natural History
Dark 364	Brownsville, Texas, United States	25,8688	-97,4376	Tropical and Subtropical Grasslands, Savannas and Shrublands	Western Gulf coastal grasslands	Photograph	1889	American Museum of Natural History
Dark 365	Brownsville, Texas, United States	26,0079	-97,4913	Tropical and Subtropical Grasslands, Savannas and Shrublands	Western Gulf coastal grasslands	Photograph	1904	American Museum of Natural History

Samples	Location	Coordinates		Biome	Ecoregion	Sample type	Year	Source
		Latitude	Longitude					
Dark 366	Towaco, Los Indios, United States	26,0442	-97,7343	Deserts and Xeric Shrublands	Tamaulipan mezquital	Photograph	1965	American Museum of Natural History
Dark 367	Cedeno, Bolivar, Venezuela	7,1631	-66,3327	Tropical and Subtropical Grasslands, Savannas and Shrublands	Llanos	Photograph	1925	American Museum of Natural History
Dark 368	Montes, Sucre, Venezuela	10,2630	-64,0468	Deserts and Xeric Shrublands	La Costa xeric shrublands	Photograph	1925	American Museum of Natural History
Dark 369	Moruy, Falcon, Venezuela	11,8282	-70,0236	Deserts and Xeric Shrublands	Paraguana xeric scrub	Photograph	1938	American Museum of Natural History
Red 01	Boqueirão da Onça National Park, Bahia, Brazil	-10,2000	-41,4167	Deserts and Xeric Shrublands	Caatinga	Report	no data	Tadeu de Oliveira
Red 02	Boqueirão da Onça National Park, Bahia, Brazil	-10,2000	-41,4167	Deserts and Xeric Shrublands	Caatinga	Report	no data	Tadeu de Oliveira
Red 03	Boqueirão da Onça National Park, Bahia, Brazil	-9,5243	-40,8171	Deserts and Xeric Shrublands	Caatinga	Report	2008	Sertão Bio
Red 04	Boqueirão da Onça National Park, Bahia, Brazil	-10,2000	-41,4167	Deserts and Xeric Shrublands	Caatinga	Report	no data	Tadeu de Oliveira
Red 05	Praia do Forte, Bahia, Brazil	-12,5500	-38,0000	Tropical and Subtropical Moist Broadleaf Forests	Atlantic Forests	Report	no data	Tadeu de Oliveira
Red 06	Antonina do Norte, Ceará, Brazil	-6,8180	-40,1672	Deserts and Xeric Shrublands	Caatinga	Capture	2006	Tadeu de Oliveira
Red 07	Antonina do Norte, Ceará, Brazil	-6,8180	-40,1672	Deserts and Xeric Shrublands	Caatinga	Capture	2006	Tadeu de Oliveira
Red 08	Antonina do Norte, Ceará, Brazil	-6,8180	-40,1672	Deserts and Xeric Shrublands	Caatinga	Capture	2006	Tadeu de Oliveira
Red 09	Antonina do Norte, Ceará, Brazil	-6,8180	-40,1672	Deserts and Xeric Shrublands	Caatinga	Capture	2006	Tadeu de Oliveira
Red 10	Antonina do Norte, Ceará, Brazil	-6,8180	-40,1672	Deserts and Xeric Shrublands	Caatinga	Capture	2006	Tadeu de Oliveira
Red 11	Antonina do Norte, Ceará, Brazil	-6,8180	-40,1672	Deserts and Xeric Shrublands	Caatinga	Capture	2006	Tadeu de Oliveira
Red 12	Antonina do Norte, Ceará, Brazil	-6,8180	-40,1672	Deserts and Xeric Shrublands	Caatinga	Capture	2006	Tadeu de Oliveira
Red 13	Antonina do Norte, Ceará, Brazil	-6,8180	-40,1672	Deserts and Xeric Shrublands	Caatinga	Capture	2006	Tadeu de Oliveira
Red 14	Antonina do Norte, Ceará, Brazil	-6,8180	-40,1672	Deserts and Xeric Shrublands	Caatinga	Capture	2006	Tadeu de Oliveira
Red 15	Antonina do Norte, Ceará, Brazil	-6,8180	-40,1672	Deserts and Xeric Shrublands	Caatinga	Capture	2006	Tadeu de Oliveira
Red 16	Antonina do Norte, Ceará, Brazil	-6,8180	-40,1672	Deserts and Xeric Shrublands	Caatinga	Capture	2006	Tadeu de Oliveira
Red 17	Caridade, Ceará, Brazil	-4,2299	-39,1895	Deserts and Xeric Shrublands	Caatinga	Report	no data	Tadeu de Oliveira
Red 18	Novo Oriente, Ceará, Brazil	-5,5358	-40,7896	Deserts and Xeric Shrublands	Caatinga	Report	no data	Tadeu de Oliveira
Red 19	Novo Oriente, Ceará, Brazil	-5,5358	-40,7896	Deserts and Xeric Shrublands	Caatinga	Report	no data	Tadeu de Oliveira
Red 20	Serra das Araras, Ceará, Brazil	-3,7333	-38,6500	Deserts and Xeric Shrublands	Caatinga	Report	no data	Tadeu de Oliveira
Red 21	Bacabal, Maranhão, Brazil	-3,7847	-46,8535	Tropical and Subtropical Moist Broadleaf Forests	Tocantins/Pindare moist forests	Photograph	no data	Tadeu de Oliveira
Red 22	Barreirinhas, Maranhão, Brazil	-2,7225	-42,8509	Tropical and Subtropical Moist Broadleaf Forests	Northeastern Brazil restingas	Report	no data	Tadeu de Oliveira
Red 23	Mirador State Park, Maranhão, Brazil	-6,6667	-45,3333	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Photograph	2009	Tadeu de Oliveira
Red 24	Medina, Minas Gerais, Brazil	-16,2167	-41,4667	Tropical and Subtropical Moist Broadleaf Forests	Atlantic Forests	Report	no data	Tadeu de Oliveira
Red 25	Paracatu, Minas Gerais, Brazil	-17,2429	-46,4696	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Photograph	2013	Henrique Alves
Red 26	Veredas do Pereaçu State Park, Minas Gerais, Brazil	-15,1182	-44,6066	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Report	2010	Guilherme Ferreira
Red 27	Cavernas do Peruaçu National Park, Minas Gerais, Brazil	-15,0842	-44,2663	Tropical and Subtropical Dry Broadleaf Forests	Atlantic Dry Forests	Photograph	2007	Instituto Biotropicos
Red 28	Fazenda Tamanduá, Paraíba, Brazil	-7,0167	-37,3833	Deserts and Xeric Shrublands	Caatinga	Report	no data	Tadeu de Oliveira
Red 29	Fazenda Tamanduá, Paraíba, Brazil	-7,0167	-37,3833	Deserts and Xeric Shrublands	Caatinga	Report	no data	Tadeu de Oliveira
Red 30	Fazenda Tamanduá, Paraíba, Brazil	-7,0167	-37,3833	Deserts and Xeric Shrublands	Caatinga	Report	no data	Tadeu de Oliveira
Red 31	Fazenda Tamanduá, Paraíba, Brazil	-7,0167	-37,3833	Deserts and Xeric Shrublands	Caatinga	Report	no data	Tadeu de Oliveira
Red 32	Patos, Paraíba, Brazil	-6,9119	-37,2299	Deserts and Xeric Shrublands	Caatinga	Report	2013	Tadeu de Oliveira
Red 33	Patos, Paraíba, Brazil	-6,8968	-37,2521	Deserts and Xeric Shrublands	Caatinga	Report	2013	Tadeu de Oliveira
Red 34	Patos, Paraíba, Brazil	-6,9204	-37,2765	Deserts and Xeric Shrublands	Caatinga	Report	2013	Tadeu de Oliveira
Red 35	São José de Piranhas, Paraíba, Brazil	-7,1167	-38,5000	Deserts and Xeric Shrublands	Caatinga	Report	no data	Tadeu de Oliveira
Red 36	Sertão Araripe, Pernambuco, Brazil	-7,4567	-40,1941	Deserts and Xeric Shrublands	Caatinga	Report	2010	Iran de Souza
Red 37	Serra da Capivara National Park, Piauí, Brazil	-8,6745	-42,6517	Deserts and Xeric Shrublands	Caatinga	Report	2000	Sertão Bio
Red 38	Serra da Capivara National Park, Piauí, Brazil	-8,7484	-42,4967	Deserts and Xeric Shrublands	Caatinga	Report	2000	Sertão Bio
Red 39	Parnaíba River, Piauí, Brazil	-8,2858	-45,6562	Tropical and Subtropical Grasslands, Savannas and Shrublands	Cerrado	Report	no data	Tadeu de Oliveira
Red 40	Arapongas, Paraná, Brazil	-23,4417	-51,4342	Tropical and Subtropical Moist Broadleaf Forests	Alto Paraná Atlantic forests	Photograph	no data	Carnivoros do Iguaçu
Red 41	Serra da Baitaca State Park, Paraná, Brazil	-25,4118	-49,0799	Tropical and Subtropical Moist Broadleaf Forests	Araucaria moist forests	Report	no data	Renata Pitman
Red 42	Iguaçu National Park, Paraná, Brazil	-25,5695	-54,2684	Tropical and Subtropical Moist Broadleaf Forests	Alto Paraná Atlantic forests	Photograph	2009	Carnivoros do Iguaçu
Red 43	Perobas Biological, Reserve, Paraná, Brazil	-23,8326	-52,7439	Tropical and Subtropical Moist Broadleaf Forests	Alto Paraná Atlantic forests	Photograph	2010	Jonatan Soares
Red 44	Perobas Biological, Reserve, Paraná, Brazil	-23,8564	-52,7692	Tropical and Subtropical Moist Broadleaf Forests	Alto Paraná Atlantic forests	Photograph	2010	Jonatan Soares
Red 45	Perobas Biological, Reserve, Paraná, Brazil	-23,8390	-52,7801	Tropical and Subtropical Moist Broadleaf Forests	Alto Paraná Atlantic forests	Photograph	2010	Jonatan Soares
Red 46	Canguçu, Rio Grande do Sul, Brazil	-31,2059	-52,8277	Tropical and Subtropical Grasslands, Savannas and Shrublands	Uruguayan savanna	Photograph	2013	Caroline Sartor
Red 47	Carazinho, Rio Grande do Sul, Brazil	-28,2872	-52,7128	Tropical and Subtropical Grasslands, Savannas and Shrublands	Uruguayan savanna	Capture	2007	IBAMA
Red 48	Cruzeiro do Sul, Rio Grande do Sul, Brazil	-29,5296	-52,0153	Tropical and Subtropical Moist Broadleaf Forests	Alto Paraná Atlantic forests	Report	2010	Carlos Benhur Kasper
Red 49	Humaitá, Rio Grande do Sul, Brazil	-27,5456	-53,9505	Tropical and Subtropical Moist Broadleaf Forests	Alto Paraná Atlantic forests	Capture	2004	FZB-RS
Red 50	Humaitá, Rio Grande do Sul, Brazil	-27,5000	-53,8623	Tropical and Subtropical Moist Broadleaf Forests	Alto Paraná Atlantic forests	Capture	2006	FZB-RS
Red 51	Humaitá, Rio Grande do Sul, Brazil	-27,6011	-53,8426	Tropical and Subtropical Moist Broadleaf Forests	Alto Paraná Atlantic forests	Capture	2008	Carlos Benhur Kasper
Red 52	Lagoa Vermelha, Rio Grande do Sul, Brazil	-28,1724	-51,5280	Tropical and Subtropical Moist Broadleaf Forests	Araucaria moist forests	Capture	2004	Eduardo Eizirik
Red 53	Lajeado, Rio Grande do Sul, Brazil	-29,4537	-51,9441	Tropical and Subtropical Moist Broadleaf Forests	Alto Paraná Atlantic forests	Photograph	2013	Flavia Tirelli
Red 54	Mariana Pimentel, Rio Grande do Sul, Brazil	-30,3379	-51,5709	Tropical and Subtropical Grasslands, Savannas and Shrublands	Uruguayan savanna	Report	2010	Carlos Benhur Kasper
Red 55	Turvo State Park, Rio Grande do Sul, Brazil	-27,2028	-53,8549	Tropical and Subtropical Moist Broadleaf Forests	Alto Paraná Atlantic forests	Photograph	2010	Carlos Benhur Kasper
Red 56	Serra Geral Biological Reserve, Rio Grande do Sul, Brazil	-29,1582	-50,0513	Tropical and Subtropical Moist Broadleaf Forests	Araucaria moist forests	Photograph	2010	Juliana Santos
Red 57	São Gabriel, Rio Grande do Sul, Brazil	-30,3444	-53,8395	Tropical and Subtropical Grasslands, Savannas and Shrublands	Uruguayan savanna	Photograph	2013	Flavia Tirelli

Samples	Location	Coordinates		Biome	Ecoregion	Sample type	Year	Source
		Latitude	Longitude					
Red 58	Seberi, Rio Grande do Sul, Brazil	-27,5129	-53,3658	Tropical and Subtropical Moist Broadleaf Forests	Araucaria moist forests	Report	2010	Carlos Benhur Kasper
Red 59	São Cristóvão do Sul, Santa Catarina, Brazil	-27,3436	-50,4298	Tropical and Subtropical Moist Broadleaf Forests	Araucaria moist forests	Photograph	2004	Jorge Cherem
Red 60	Chapecó, Santa Catarina, Brazil	-27,2039	-52,6287	Tropical and Subtropical Moist Broadleaf Forests	Alto Paraná Atlantic forests	Photograph	2009	Jorge Cherem
Red 61	Serra do Tabuleiro State Park, Santa Catarina, Brazil	-27,8490	-48,7107	Tropical and Subtropical Moist Broadleaf Forests	Atlantic Forests	Report	no data	Marcos Tortatto
Red 62	Serra do Itajaí State Park, Santa Catarina, Brazil	-27,0387	-49,2211	Tropical and Subtropical Moist Broadleaf Forests	Atlantic Forests	Photograph	2010	CENAP ICMBio
Red 63	Serra do Itajaí State Park, Santa Catarina, Brazil	-27,0387	-49,2211	Tropical and Subtropical Moist Broadleaf Forests	Atlantic Forests	Photograph	2010	CENAP ICMBio
Red 64	Xanxerê, Santa Catarina, Brazil	-26,8322	-52,4145	Tropical and Subtropical Moist Broadleaf Forests	Araucaria moist forests	Photograph	2004	Jorge Cherem
Red 65	Palmas, Tocantins, Brazil	-10,1132	-48,2618	Tropical and Subtropical Moist Broadleaf Forests	Mato Grosso seasonal forests	Report	2011	Guilherme Trovati
Red 66	Bella Vista, Corrientes, Argentina	-27,0336	-65,2915	Tropical and Subtropical Grasslands, Savannas and Shrublands	Dry Chaco	Photograph	no data	Anibal Parera
Red 67	Lihue, Argentina	-37,6449	-65,6285	Temperate Grasslands, Savannas and Shrublands	Espinal	Report	no data	Javier Pereira
Red 68	Wildermuth Reserve, Santa Fe, Argentina	-32,1247	-61,3858	Temperate Grasslands, Savannas and Shrublands	Humid Pampas	Photograph	2012	Javier Pereira
Red 69	Cerro Cortado, Bolivia	-19,4489	-62,3731	Tropical and Subtropical Grasslands, Savannas and Shrublands	Dry Chaco	Photograph	no data	Leonardo Maffei
Red 70	Villavicencio, Colombia	4,0284	-73,6138	Tropical and Subtropical Dry Broadleaf Forests	Apure-Villavicencio dry forests	Photograph	1972	Esteban Payan, Panthera
Red 71	San Fernando, Mexico	24,7929	-98,0020	Deserts and Xeric Shrublands	Tamaulipan mezquital	Photograph	no data	Michael Tewes
Red 72	Tamaulipas, Mexico	24,0131	-98,6251	Deserts and Xeric Shrublands	Tamaulipan matorral	Photograph	2013	Francisco Illescas
Red 73	Ledesma, Jujuy, Argentina	-23,8438	-64,7711	Tropical and Subtropical Grasslands, Savannas and Shrublands	Dry Chaco	Photograph	1959	American Museum of Natural History
Red 74	Santiago Del Estero, Argentina	-27,8297	-64,3222	Tropical and Subtropical Grasslands, Savannas and Shrublands	Dry Chaco	Photograph	1916	American Museum of Natural History
Red 75	El Puente, Bolivia	-21,2867	-65,2095	Tropical and Subtropical Grasslands, Savannas and Shrublands	Dry Chaco	Photograph	s/ data	American Museum of Natural History
Red 76	Belém, Pará, Brazil	-1,8253	-48,4292	Tropical and Subtropical Moist Broadleaf Forests	Tocantins/Pindare moist forests	Photograph	1982	Tiago Freitas, MPEG
Red 77	Tocantins River, Tucuruí, Pará, Brazil	-5,3084	-48,8845	Tropical and Subtropical Moist Broadleaf Forests	Tocantins/Pindare moist forests	Photograph	1988	Tiago Freitas, MPEG
Red 78	Entre Rios do Sul, Rio Grande do Sul, Brazil	-27,5311	-52,7196	Tropical and Subtropical Grasslands, Savannas and Shrublands	Uruguayan savanna	Photograph	no data	Lucas Gonçalves da Silva
Red 79	Vila São Francisco, Urubici, Santa Catarina, Brazil	-28,0252	-49,6021	Tropical and Subtropical Moist Broadleaf Forests	Araucaria moist forests	Photograph	1988	Jorge Cherem
Red 80	Palmas, Tocantins, Brazil	-9,9500	-48,3333	Tropical and Subtropical Moist Broadleaf Forests	Mato Grosso seasonal forests	Report	no data	Tadeu de Oliveira
Red 81	Bogota, Cundinamarca, Colombia	4,5705	-73,9791	Tropical and Subtropical Dry Broadleaf Forests	Apure-Villavicencio dry forests	Photograph	no data	American Museum of Natural History
Red 82	Paramo de Chingasa, Colombia	4,5000	-73,7500	Tropical and Subtropical Dry Broadleaf Forests	Apure-Villavicencio dry forests	Report	no data	Tadeu de Oliveira
Red 83	La Libertad, Peten, Guatemala	16,7654	-90,1563	Tropical and Subtropical Moist Broadleaf Forests	Petén-Veracruz moist forests	Photograph	1925	Smithsonian Institution
Red 84	Peten, Guatemala	17,2167	-89,6167	Tropical and Subtropical Moist Broadleaf Forests	Petén-Veracruz moist forests	Photograph	no data	Tadeu de Oliveira
Red 85	Cintalapa, Chiapas, Mexico	16,6073	-93,9618	Tropical and Subtropical Dry Broadleaf Forests	Chiapas Depression dry forests	Photograph	1951	American Museum of Natural History
Red 86	Escuinapa, Sinaloa, Mexico	22,8677	-105,7760	Tropical and Subtropical Dry Broadleaf Forests	Sinaloan dry forests	Photograph	1904	American Museum of Natural History
Red 87	Gomez Farias, Tamaulipas, Mexico	23,0487	-99,1605	Tropical and Subtropical Moist Broadleaf Forests	Veracruz moist forests	Photograph	1951	American Museum of Natural History
Red 88	Juchitan, Oaxaca, Mexico	16,4538	-94,9998	Tropical and Subtropical Dry Broadleaf Forests	Southern Pacific dry forests	Photograph	1962	American Museum of Natural History
Red 89	La Tuxpena, Champoton, Mexico	19,3500	-90,7167	Tropical and Subtropical Dry Broadleaf Forests	Yucatán dry forests	Report	no data	Tadeu de Oliveira
Red 90	La Tuxpena, Champoton, Mexico	27,0875	-102,8271	Deserts and Xeric Shrublands	Chihuahuan desert	Photograph	1911	Smithsonian Institution
Red 91	Tehuantepec, Oaxaca, Mexico	16,3628	-95,2211	Tropical and Subtropical Dry Broadleaf Forests	Southern Pacific dry forests	Photograph	no data	American Museum of Natural History
Red 92	Brownsville, Cameron County, Texas, United States	26,1806	-97,4368	Tropical and Subtropical Grasslands, Savannas and Shrublands	Western Gulf coastal grasslands	Photograph	1892	Smithsonian Institution
Red 93	Brownsville, Texas, United States	25,9167	-97,4833	Tropical and Subtropical Grasslands, Savannas and Shrublands	Western Gulf coastal grasslands	Report	no data	Tadeu de Oliveira
Red 94	Iquitos, Maynas, Peru	-3,7523	-73,1159	Tropical and Subtropical Moist Broadleaf Forests	Napo moist forests	Photograph	2002	Esteban Payan, Panthera

APÊNDICE 3: TABELA SUPLEMENTAR CAPÍTULO 4

Registros *Panthera pardus*

Supplementary table 1 - Location records for *Panthera pardus.*

Id	Subspecies	Location	Deg. - WGS84		Biome	Ecorregion	Sample	Year	Source
			Latitude	Longitude					
Doubtful Mel. 01	*saxicolor*	Tandoureh National Park, Iran	37,3762	58,5006	Temperate Coniferous Forest	Caucasus-Anatolian-Hyrcanian temperate forests	Report	no data	Asian Leopard Group
Doubtful Mel. 02	*pardus*	Chyulu Hills National Park, Kenya	-2,8161	38,1473	Tropical and Subtropical Grasslands, Savannas and Shrublands	East African Acacia Savannas	Report	no data	Lion Guardians
Doubtful Mel. 03	*pardus*	Mount Kenya's, Kenya	-0,3062	37,1866	Tropical and Subtropical Moist Broadleaf Forests	East African montane forests	Report	no data	Video Mount Kenya/Sunquist & Sunquist 2002
Doubtful Mel. 04	*pardus*	Lydenburg, South Africa	-24,9221	30,6565	Montane Grasslands and Shrublands	Drakensberg Montane Woodlands and Grasslands	Report	no data	Report by Andrew Stein
Melanistic 01	*fusca*	Manas National Park, Bhutan	26,8011	91,0330	Tropical and Subtropical Moist Broadleaf Forests	Brahmaputra Valley semi-evergreen forests	Photograph	no data	Smithsonian Institution
Melanistic 02	*fusca*	Tsamang, Monggar, Bhutan	27,5048	91,1057	Temperate Broadleaf and Mixed Forests	Eastern Himalayan broadleaf forests	Photograph	no data	Smithsonian Institution
Melanistic 03	*fusca*	Southern Lung, China	28,2364	92,7316	Montane Grasslands and Shrublands	Eastern Himalayan alpine shrub and meadows	Photograph	no data	Smithsonian Institution
Melanistic 04	*fusca*	Addis Ababa, Abissynya, Ethiopia	9,0445	38,6967	Montane Grasslands and Shrublands	Ethiopian montane grasslands and woodlands	Photograph	1909	National Museum of Natural History USA
Melanistic 05	*fusca*	Achanakmar Tiger Reserve, India	22,4528	81,5555	Tropical and Subtropical Moist Broadleaf Forests	Eastern highlands moist deciduous forests	Report	no data	Milind Pariwakam/Biswajit Mohanty
Melanistic 06	*fusca*	Achanakmar Tiger Reserve, India	22,5980	81,8327	Tropical and Subtropical Moist Broadleaf Forests	Eastern highlands moist deciduous forests	Photograph	no data	Milind Pariwakam/Biswajit Mohanty
Melanistic 07	*fusca*	Achanakmar Tiger Reserve, India	22,3421	81,8245	Tropical and Subtropical Moist Broadleaf Forests	Eastern highlands moist deciduous forests	Report	no data	Milind Pariwakam/Biswajit Mohanty
Melanistic 08	*fusca*	Bhadra Tiger Reserve, India	13,4910	75,6496	Tropical and Subtropical Moist Broadleaf Forests	North Western Ghats moist deciduous forests	Photograph	2012	Conservation India
Melanistic 09	*fusca*	Bhadra Tiger Reserve, India	13,6189	75,6286	Tropical and Subtropical Moist Broadleaf Forests	North Western Ghats moist deciduous forests	Photograph	2012	Conservation India
Melanistic 10	*fusca*	Chhattisgarh, India	23,9813	82,0120	Tropical and Subtropical Dry Broadleaf Forests	Narmada Valley dry deciduous forests	Report	no data	Milind Pariwakam/Biswajit Mohanty
Melanistic 11	*fusca*	Dandeli-Anshi Tiger Reserve, india	13,1213	75,0433	Tropical and Subtropical Moist Broadleaf Forests	Malabar Coast moist forests	Photograph	2013	Wildlife Conservation Society
Melanistic 12	*fusca*	Dibrugarh, India	27,4848	95,0622	Tropical and Subtropical Moist Broadleaf Forests	Brahmaputra Valley semi-evergreen forests	Photograph	no data	Kashmira Kakati
Melanistic 13	*fusca*	Kaziranga National Park, India	26,6911	93,4945	Tropical and Subtropical Moist Broadleaf Forests	Brahmaputra Valley semi-evergreen forests	Photograph	no data	World Wild Fund
Melanistic 14	*fusca*	Maijan Bungalow Brahmaputra Ghat, India	27,5008	94,9323	Tropical and Subtropical Moist Broadleaf Forests	Brahmaputra Valley semi-evergreen forests	Photograph	no data	Kashmira Kakati
Melanistic 15	*fusca*	Mudumalai National Park, Central India, India	11,5087	76,5651	Tropical and Subtropical Moist Broadleaf Forests	South Western Ghats moist deciduous forests	Photograph	2013	Phillip Ross
Melanistic 16	*fusca*	Orissa, India	20,3555	80,9707	Tropical and Subtropical Moist Broadleaf Forests	Eastern highlands moist deciduous forests	Report	no data	Milind Pariwakam/Biswajit Mohanty
Melanistic 17	*fusca*	Pakke Tiger Reserve in Arunachal Pradesh, India	28,5669	95,9691	Temperate Broadleaf and Mixed Forests	Eastern Himalayan broadleaf forests	Photograph	2013	Milind Pariwakam/Biswajit Mohanty
Melanistic 18	*fusca*	Pakke Tiger Reserve in Arunachal Pradesh, India	28,6604	95,6358	Temperate Broadleaf and Mixed Forests	Eastern Himalayan broadleaf forests	Photograph	no data	Milind Pariwakam/Biswajit Mohanty
Melanistic 19	*fusca*	Periyar Wildlife Sanctuary, India	9,2756	76,9211	Tropical and Subtropical Moist Broadleaf Forests	South Western Ghats moist deciduous forests	Report	no data	Milind Pariwakam/Biswajit Mohanty
Melanistic 20	*melas*	Baluran National Park, Java, Indonesia	-7,8531	114,4085	Tropical and Subtropical Moist Broadleaf Forests	Eastern Java-Bali rain forests	Photograph	2012	Copenhague Zoo
Melanistic 21	*melas*	Gunung Gede Pangrango National Park, West Java, Indonesia	-6,8038	106,9310	Tropical and Subtropical Moist Broadleaf Forests	Western Java montane rain forests	Photograph	no data	Anton Ario
Melanistic 22	*melas*	Gunung Salak National Park, Java, Indonesia	-7,1238	107,3197	Tropical and Subtropical Moist Broadleaf Forests	Western Java montane rain forests	Photograph	no data	CIFOR
Melanistic 23	*melas*	Halimun-Salak, Java, Indonesia	-6,7671	106,5601	Tropical and Subtropical Moist Broadleaf Forests	Western Java montane rain forests	Photograph	2004	Anhar Harahap
Melanistic 24	*melas*	Halimun-Salak, Java, Indonesia	-6,7832	106,6828	Tropical and Subtropical Moist Broadleaf Forests	Western Java montane rain forests	Photograph	2005	Anhar Harahap
Melanistic 25	*melas*	Ujung Kulon National Park, Java, Indonesia	-6,7524	105,3290	Tropical and Subtropical Moist Broadleaf Forests	Western Java rain forests	Photograph	no data	World Wild Fund
Melanistic 26	*melas*	Western Java, Indonesia	-6,6280	105,9386	Tropical and Subtropical Moist Broadleaf Forests	Western Java rain forests	Photograph	1907	National Museum of Natural History USA
Melanistic 27	*delacouri*	Kenyir Wildlife Corridor, Malaysia	5,2801	102,6407	Tropical and Subtropical Moist Broadleaf Forests	Peninsular Malaysian rain forests	Photograph	2012	Reuben Clements
Melanistic 28	*delacouri*	Kenyir Wildlife Corridor, Malaysia	5,1205	102,9918	Tropical and Subtropical Moist Broadleaf Forests	Peninsular Malaysian rain forests	Photograph	no data	Kenyir Wildlife Corridor Leopard Project
Melanistic 29	*delacouri*	Kenyir Wildlife Corridor, Malaysia	5,2390	102,7215	Tropical and Subtropical Moist Broadleaf Forests	Peninsular Malaysian rain forests	Photograph	2011	Kae Kawanishi
Melanistic 30	*delacouri*	Malay Peninsula, Malaysia	3,3657	102,1930	Tropical and Subtropical Moist Broadleaf Forests	Peninsular Malaysian rain forests	Photograph	2009	Kae Kawanishi
Melanistic 31	*delacouri*	Malay Peninsula, Malaysia	4,4303	103,1427	Tropical and Subtropical Moist Broadleaf Forests	Peninsular Malaysian rain forests	Photograph	2009	Kae Kawanishi
Melanistic 32	*delacouri*	Malay Peninsula, Malaysia	4,4536	102,5160	Tropical and Subtropical Moist Broadleaf Forests	Peninsular Malaysian rain forests	Photograph	2009	Kae Kawanishi
Melanistic 33	*delacouri*	Malay Peninsula, Malaysia	4,2904	102,3561	Tropical and Subtropical Moist Broadleaf Forests	Peninsular Malaysian rain forests	Photograph	2009	Kae Kawanishi
Melanistic 34	*delacouri*	Malay Peninsula, Malaysia	4,0748	102,8376	Tropical and Subtropical Moist Broadleaf Forests	Peninsular Malaysian rain forests	Photograph	2009	Kae Kawanishi
Melanistic 35	*delacouri*	Malay Peninsula, Malaysia	4,1564	102,5324	Tropical and Subtropical Moist Broadleaf Forests	Peninsular Malaysian rain forests	Photograph	2009	Kae Kawanishi
Melanistic 36	*delacouri*	Malay Peninsula, Malaysia	4,2963	102,7504	Tropical and Subtropical Moist Broadleaf Forests	Peninsular Malaysian rain forests	Photograph	2009	Kae Kawanishi
Melanistic 37	*delacouri*	Malay Peninsula, Malaysia	5,4888	102,1140	Tropical and Subtropical Moist Broadleaf Forests	Peninsular Malaysian rain forests	Photograph	2009	Kae Kawanishi
Melanistic 38	*delacouri*	Malay Peninsula, Malaysia	5,7067	101,9804	Tropical and Subtropical Moist Broadleaf Forests	Peninsular Malaysian rain forests	Photograph	2009	Kae Kawanishi
Melanistic 39	*delacouri*	Malay Peninsula, Malaysia	5,4091	101,6545	Tropical and Subtropical Moist Broadleaf Forests	Peninsular Malaysian rain forests	Photograph	2009	Kae Kawanishi
Melanistic 40	*delacouri*	Malay Peninsula, Malaysia	5,6240	101,7890	Tropical and Subtropical Moist Broadleaf Forests	Peninsular Malaysian rain forests	Photograph	2009	Kae Kawanishi
Melanistic 41	*delacouri*	Malay Peninsula, Malaysia	5,7618	101,5769	Tropical and Subtropical Moist Broadleaf Forests	Peninsular Malaysian rain forests	Photograph	2009	Kae Kawanishi
Melanistic 42	*delacouri*	Malay Peninsula, Thailand	12,8965	99,3874	Tropical and Subtropical Moist Broadleaf Forests	Kayah-Karen/Tenasserim moist forests	Photograph	2009	Kae Kawanishi
Melanistic 43	*delacouri*	Malay Peninsula, Thailand	13,1375	99,2334	Tropical and Subtropical Moist Broadleaf Forests	Kayah-Karen/Tenasserim moist forests	Photograph	2009	Kae Kawanishi
Melanistic 44	*delacouri*	Malay Peninsula, Malaysia	6,1715	101,0211	Tropical and Subtropical Moist Broadleaf Forests	Peninsular Malaysian rain forests	Photograph	no data	American Museum of Natural History USA
Melanistic 45	*delacouri*	Taman Negara Park, Malaysia	5,2790	102,4918	Tropical and Subtropical Moist Broadleaf Forests	Peninsular Malaysian rain forests	Photograph	2010	Kae Kawanishi
Melanistic 46	*fusca*	Kangchenjunga Conservation Area, Nepal	27,7408	87,9714	Montane Grasslands and Shrublands	Eastern Himalayan alpine meadows	Photograph	2013	Thapa et al 2013
Melanistic 47	*kotiya*	Deniyaya, Sri Lanka	6,7561	80,6977	Tropical and Subtropical Moist Broadleaf Forests	Sri Lankan moist forest	Photograph	no data	Andrew Kittle
Melanistic 48	*delacouri*	Ban Krang, Thailand	16,7477	100,2027	Tropical and Subtropical Moist Broadleaf Forests	Chao Phraya freshwater swamp forests	Photograph	no data	American Museum of Natural History USA
Melanistic 49	*delacouri*	Chiang Mai, Thailand	18,7627	98,8565	Tropical and Subtropical Moist Broadleaf Forests	Kayah-Karen/Tenasserim moist forests	Photograph	2013	Bruce Kekule
Melanistic 50	*delacouri*	Huai Kha Khaeng Wildlife Sanctuary, Thailand	15,6539	99,5247	Tropical and Subtropical Dry Broadleaf Forests	Indochina dry forests	Photograph	2009	Bruce Kekule
Melanistic 51	*delacouri*	Huai Kha Khaeng Wildlife Sanctuary, Thailand	15,1661	99,2784	Tropical and Subtropical Moist Broadleaf Forests	Kayah-Karen/Tenasserim moist forests	Photograph	2013	Bruce Kekule
Melanistic 52	*delacouri*	Huai Kha Khaeng Wildlife Sanctuary, Thailand	15,6986	98,7621	Tropical and Subtropical Moist Broadleaf Forests	Kayah-Karen/Tenasserim moist forests	Photograph	no data	Kae Kawanishi
Melanistic 53	*delacouri*	Huai Kha Khaeng Wildlife Sanctuary, Thailand	15,5612	98,9229	Tropical and Subtropical Moist Broadleaf Forests	Kayah-Karen/Tenasserim moist forests	Photograph	2013	Bruce Kekule
Melanistic 54	*delacouri*	Huai Kha Khaeng Wildlife Sanctuary, Thailand	15,0417	98,3983	Tropical and Subtropical Moist Broadleaf Forests	Chao Phraya lowland moist deciduous forests	Photograph	2012	Wildlife Conservation Society
Melanistic 55	*delacouri*	Huai Kha Khaeng Wildlife Sanctuary, Thailand	14,4518	98,8936	Tropical and Subtropical Moist Broadleaf Forests	Chao Phraya lowland moist deciduous forests	Photograph	2012	Wildlife Conservation Society
Melanistic 56	*delacouri*	Huai Kha Khaeng Wildlife Sanctuary, Thailand	15,3042	99,2820	Tropical and Subtropical Moist Broadleaf Forests	Kayah-Karen/Tenasserim moist forests	Photograph	2013	Wildlife Conservation Society

Id	Subspecies	Location	Deg. - WGS84		Biome	Ecorregion	Sample	Year	Source
			Latitude	Longitude					
Melanistic 57	*delacouri*	Huai Kha Khaeng Wildlife Sanctuary, Thailand	15,1038	99,1074	Tropical and Subtropical Moist Broadleaf Forests	Kayah-Karen/Tenasserim moist forests	Photograph	2013	Wildlife Conservation Society
Melanistic 58	*delacouri*	Huai Kha Khaeng Wildlife Sanctuary, Thailand	15,1941	98,9874	Tropical and Subtropical Moist Broadleaf Forests	Kayah-Karen/Tenasserim moist forests	Photograph	2013	Wildlife Conservation Society
Melanistic 59	*delacouri*	Kaeng Krachan National Park, Thailand	13,0750	99,5457	Tropical and Subtropical Moist Broadleaf Forests	Kayah-Karen/Tenasserim moist forests	Photograph	2009	Bruce Kekule
Melanistic 60	*delacouri*	Kaeng Krachan National Park, Thailand	13,1241	99,4217	Tropical and Subtropical Moist Broadleaf Forests	Kayah-Karen/Tenasserim moist forests	Photograph	2009	Bruce Kekule
Melanistic 61	*delacouri*	Kaeng Krachan National Park, Thailand	13,0125	99,2634	Tropical and Subtropical Moist Broadleaf Forests	Kayah-Karen/Tenasserim moist forests	Photograph	2009	Bruce Kekule
Melanistic 62	*delacouri*	Khao Sok National Park, Thailand	8,9317	98,5110	Tropical and Subtropical Moist Broadleaf Forests	Kayah-Karen/Tenasserim moist forests	Photograph	no data	Wildlife Conservation Society
Melanistic 63	*delacouri*	Kuiburi National Park, Thailand	12,3004	99,5971	Tropical and Subtropical Moist Broadleaf Forests	Kayah-Karen/Tenasserim moist forests	Photograph	no data	Kae Kawanishi
Melanistic 64	*delacouri*	Malay Peninsula, Thailand	8,5951	98,4122	Tropical and Subtropical Moist Broadleaf Forests	Kayah-Karen/Tenasserim moist forests	Photograph	2009	Kae Kawanishi
Melanistic 65	*delacouri*	Malay Peninsula, Malaysia	3,2732	102,3561	Tropical and Subtropical Moist Broadleaf Forests	Peninsular Malaysian rain forests	Photograph	2009	Kae Kawanishi
Melanistic 66	*delacouri*	Ban Krang, Thailand	12,9953	99,3327	Tropical and Subtropical Moist Broadleaf Forests	Kayah-Karen/Tenasserim moist forests	Photograph	2013	Bruce Kekule
Melanistic 67	*delacouri*	Kenyir Wildlife Corridor, Malaysia	4,7589	102,8283	Tropical and Subtropical Moist Broadleaf Forests	Peninsular Malaysian rain forests	Photograph	2013	International Society of Zoological Sciences
Non-melanistic 01	*fusca*	Afeghanistan Central Highlands, Afeghanistan	35,4703	70,7899	Montane Grasslands and Shrublands	Middle Asian montane woodlands and steppe	Photograph	2011	Wildlife Conservation Society
Non-melanistic 02	*pardus*	Chitau, Bie, Angola	-12,9522	22,6538	Tropical and Subtropical Grasslands, Savannas and Shrublands	Angolan Miombo woodlands	Photograph	1925	American Museum of Natural History USA
Non-melanistic 03	*pardus*	Chitau, Bie, Angola	-12,9522	22,6538	Tropical and Subtropical Grasslands, Savannas and Shrublands	Angolan Miombo woodlands	Photograph	1925	American Museum of Natural History USA
Non-melanistic 04	*pardus*	Chitau, Bie, Angola	-12,9522	22,6538	Tropical and Subtropical Grasslands, Savannas and Shrublands	Angolan Miombo woodlands	Photograph	1925	American Museum of Natural History USA
Non-melanistic 05	*pardus*	Chitau, Bie, Angola	-12,7876	22,6620	Tropical and Subtropical Grasslands, Savannas and Shrublands	Angolan Miombo woodlands	Photograph	1925	American Museum of Natural History USA
Non-melanistic 06	*pardus*	Chitau, Bie, Angola	-12,7876	22,6620	Tropical and Subtropical Grasslands, Savannas and Shrublands	Angolan Miombo woodlands	Photograph	1925	American Museum of Natural History USA
Non-melanistic 07	*saxicolor*	Zanguezur State Sanctuary, Armenia	39,0436	46,4373	Temperate Broadleaf and Mixed Forests	Caucasus-Anatolian-Hyrcanian temperate forests	Photograph	no data	Thomas Gray
Non-melanistic 08	*fusca*	Manas National Park, Bhutan	26,8923	91,0124	Tropical and Subtropical Moist Broadleaf Forests	Himalayan subtropical broadleaf forests	Photograph	no data	Smithsonian Institution
Non-melanistic 09	*fusca*	Manas National Park, Bhutan	26,8480	91,1996	Tropical and Subtropical Moist Broadleaf Forests	Himalayan subtropical broadleaf forests	Photograph	no data	Smithsonian Institution
Non-melanistic 10	*fusca*	Manas National Park, Bhutan	26,8270	91,1957	Tropical and Subtropical Moist Broadleaf Forests	Himalayan subtropical broadleaf forests	Photograph	no data	Smithsonian Institution
Non-melanistic 11	*pardus*	Central Kalahari Reserve, Botswana	-23,1392	24,1780	Deserts and Xeric Shrublands	Kalahari xeric savanna	Photograph	no data	Andrew Stein
Non-melanistic 12	*pardus*	Central Kalahari Reserve, Botswana	-23,1096	24,0939	Deserts and Xeric Shrublands	Kalahari xeric savanna	Photograph	no data	Andrew Stein
Non-melanistic 13	*pardus*	Central Kalahari Reserve, Botswana	-22,1384	23,7266	Deserts and Xeric Shrublands	Kalahari xeric savanna	Photograph	no data	Andrew Stein
Non-melanistic 14	*pardus*	Central Kalahari Reserve, Botswana	-21,7793	23,2238	Tropical and Subtropical Grasslands, Savannas and Shrublands	Kalahari Acacia-Baikiaea woodlands	Photograph	no data	Andrew Stein
Non-melanistic 15	*pardus*	Central Kalahari Reserve, Botswana	-21,5270	24,1481	Tropical and Subtropical Grasslands, Savannas and Shrublands	Kalahari Acacia-Baikiaea woodlands	Photograph	no data	Andrew Stein
Non-melanistic 16	*pardus*	Central Kalahari Reserve, Botswana	-21,2204	23,3095	Tropical and Subtropical Grasslands, Savannas and Shrublands	Kalahari Acacia-Baikiaea woodlands	Photograph	no data	Andrew Stein
Non-melanistic 17	*pardus*	Chobe National Park, Botswana	-18,8340	24,1883	Tropical and Subtropical Grasslands, Savannas and Shrublands	Zambezian and Mopane woodlands	Photograph	no data	Andrew Stein
Non-melanistic 18	*pardus*	Chobe National Park, Botswana	-18,5234	24,4231	Tropical and Subtropical Grasslands, Savannas and Shrublands	Zambezian Baikiaea woodlands	Photograph	no data	Andrew Stein
Non-melanistic 19	*pardus*	Chobe National Park, Botswana	-18,2749	24,4725	Tropical and Subtropical Grasslands, Savannas and Shrublands	Zambezian Baikiaea woodlands	Photograph	no data	Andrew Stein
Non-melanistic 20	*pardus*	Ghanzi, Botswana	-21,5383	21,5976	Tropical and Subtropical Grasslands, Savannas and Shrublands	Kalahari Acacia-Baikiaea woodlands	Photograph	no data	Andrew Stein
Non-melanistic 21	*pardus*	Kgalagadi Transfrontier Park, Botswana	-25,5575	20,7679	Deserts and Xeric Shrublands	Kalahari xeric savanna	Photograph	no data	Andrew Stein
Non-melanistic 22	*pardus*	Kgalagadi Transfrontier Park, Botswana	-24,9999	21,1966	Deserts and Xeric Shrublands	Kalahari xeric savanna	Photograph	no data	Andrew Stein
Non-melanistic 23	*pardus*	Kgalagadi Transfrontier Park, Botswana	-24,5926	20,3313	Deserts and Xeric Shrublands	Kalahari xeric savanna	Photograph	no data	Andrew Stein
Non-melanistic 24	*pardus*	Kgalagadi Transfrontier Park, Botswana	-24,5773	20,3227	Deserts and Xeric Shrublands	Kalahari xeric savanna	Photograph	no data	Andrew Stein
Non-melanistic 25	*pardus*	Okavango Delta, Botswana	-18,3912	23,2474	Tropical and Subtropical Grasslands, Savannas and Shrublands	Zambezian Baikiaea woodlands	Photograph	no data	Andrew Stein
Non-melanistic 26	*pardus*	Tsao, Botswana	-20,4123	21,4723	Tropical and Subtropical Grasslands, Savannas and Shrublands	Kalahari Acacia-Baikiaea woodlands	Photograph	2009	Andrew Stein
Non-melanistic 27	*pardus*	Tsao, Botswana	-20,4123	21,4723	Tropical and Subtropical Grasslands, Savannas and Shrublands	Kalahari Acacia-Baikiaea woodlands	Photograph	2009	Andrew Stein
Non-melanistic 28	*pardus*	Tsao, Botswana	-20,4123	21,4723	Tropical and Subtropical Grasslands, Savannas and Shrublands	Kalahari Acacia-Baikiaea woodlands	Photograph	2009	Andrew Stein
Non-melanistic 29	*pardus*	Tuli Reserve, Botswana	-21,9139	28,9188	Tropical and Subtropical Grasslands, Savannas and Shrublands	Zambezian and Mopane woodlands	Photograph	no data	Andrew Stein
Non-melanistic 30	*delacouri*	Mondulkiri, Cambodia	12,4594	107,3662	Tropical and Subtropical Dry Broadleaf Forests	Southeastern Indochina dry evergreen forests	Photograph	2009	Bruce Kekule
Non-melanistic 31	*delacouri*	Mondulkiri Eastern Plains, Cambodia	12,5022	107,5279	Tropical and Subtropical Dry Broadleaf Forests	Southeastern Indochina dry evergreen forests	Photograph	2009	Bruce Kekule
Non-melanistic 32	*delacouri*	Mondulkiri Protected Forest, Cambodia	12,7827	106,9304	Tropical and Subtropical Dry Broadleaf Forests	Central Indochina dry forests	Photograph	no data	Bruce Kekule
Non-melanistic 33	*delacouri*	Srepok Wilderness Area, Cambodia	13,0865	107,3496	Tropical and Subtropical Dry Broadleaf Forests	Central Indochina dry forests	Photograph	no data	Bruce Kekule
Non-melanistic 34	*pardus*	Meuban, Cameroon	2,4069	12,6924	Tropical and Subtropical Moist Broadleaf Forests	Northwestern Congolian lowland forests	Photograph	1935	American Museum of Natural History USA
Non-melanistic 35	*pardus*	Ngoundi, Cameroon	3,8528	15,1198	Tropical and Subtropical Moist Broadleaf Forests	Northwestern Congolian lowland forests	Photograph	1935	American Museum of Natural History USA
Non-melanistic 36	*orientalis*	Duhuangzi, China	43,3754	130,8418	Temperate Broadleaf and Mixed Forests	Manchurian mixed forests	Photograph	2011	Shu Jin Luo
Non-melanistic 37	*japonensis*	Fu Tan, Yen Ching Kao, Szechuan, China	31,1713	103,6034	Temperate Coniferous Forest	Hengduan Shan conifer forests	Photograph	1922	American Museum of Natural History USA
Non-melanistic 38	*japonensis*	Fujian, China	26,1299	119,3211	Tropical and Subtropical Moist Broadleaf Forests	Southeast China-Hainan moist forests	Photograph	1925	American Museum of Natural History USA
Non-melanistic 39	*japonensis*	Fuqing, Fujian, China	25,7475	119,3734	Tropical and Subtropical Moist Broadleaf Forests	Southeast China-Hainan moist forests	Photograph	1916	American Museum of Natural History USA
Non-melanistic 40	*japonensis*	Futsing, Fukien Province, China	26,4773	119,2144	Tropical and Subtropical Moist Broadleaf Forests	Southeast China-Hainan moist forests	Photograph	no data	American Museum of Natural History USA
Non-melanistic 41	*orientalis*	Hunchun Amur Tiger National Nature Reserve, China	43,1131	130,5932	Temperate Broadleaf and Mixed Forests	Manchurian mixed forests	Photograph	2012	Wildlife Conservation Society
Non-melanistic 42	*orientalis*	Hunchun Amur Tiger National Nature Reserve, China	43,1737	130,6676	Temperate Broadleaf and Mixed Forests	Manchurian mixed forests	Photograph	2012	Wildlife Conservation Society
Non-melanistic 43	*japonensis*	Kuan Shien, Sichuan, China	28,5850	111,8209	Temperate Broadleaf and Mixed Forests	Changjiang Plain evergreen forests	Photograph	1932	National Museum of Natural History USA
Non-melanistic 44	*fucsia*	Lung, China	31,0137	93,1163	Montane Grasslands and Shrublands	Southeast Tibet shrublands and meadows	Photograph	1948	American Museum of Natural History USA
Non-melanistic 45	*fusca*	Mengmang, China	30,7464	93,1432	Montane Grasslands and Shrublands	Southeast Tibet shrublands and meadows	Photograph	no data	American Museum of Natural History USA
Non-melanistic 46	*orientalis*	Mijang, China	43,1356	130,2399	Temperate Broadleaf and Mixed Forests	Manchurian mixed forests	Photograph	2013	Wildlife Conservation Society
Non-melanistic 47	*japonensis*	Minchou, Gansu, China	26,2164	119,0907	Tropical and Subtropical Moist Broadleaf Forests	Southeast China-Hainan moist forests	Photograph	1911	National Museum of Natural History USA
Non-melanistic 48	*japonensis*	Nanping, Fujian Province, China	26,6246	118,1872	Tropical and Subtropical Moist Broadleaf Forests	Southeast China-Hainan moist forests	Photograph	1920	American Museum of Natural History USA
Non-melanistic 49	*japonensis*	Shansi, Hezhou, China	23,9024	111,7892	Tropical and Subtropical Moist Broadleaf Forests	Southeast China-Hainan moist forests	Photograph	no data	Asian Leopard Project
Non-melanistic 50	*japonensis*	Shanxi Province, China	37,8071	114,2488	Temperate Broadleaf and Mixed Forests	Central China loess plateau mixed forests	Photograph	no data	Asian Leopard Project
Non-melanistic 51	*japonensis*	Shanxi Province, China	37,5338	114,0875	Temperate Broadleaf and Mixed Forests	Central China loess plateau mixed forests	Photograph	no data	Asian Leopard Project

Id	Subspecies	Location	Deg. - WGS84		Biome	Ecorregion	Sample	Year	Source
			Latitude	Longitude					
Non-melanistic 52	*fusca*	Sichuan, China	33,2854	98,7018	Montane Grasslands and Shrublands	Southeast Tibet shrublands and meadows	Photograph	2008	Smithsonian Institution
Non-melanistic 53	*japonensis*	Suifu, Tseo-Jia-Keo, Sichuan, China	28,7546	104,7215	Temperate Broadleaf and Mixed Forests	Sichuan Basin evergreen broadleaf forests	Photograph	1927	National Museum of Natural History USA
Non-melanistic 54	*japonensis*	Suifu, Tseo-Jia-Keo, Sichuan, China	28,6382	104,7183	Temperate Broadleaf and Mixed Forests	Sichuan Basin evergreen broadleaf forests	Photograph	1929	National Museum of Natural History USA
Non-melanistic 55	*japonensis*	Suifu, Tseo-Jia-Keo, Sichuan, China	28,7636	104,7596	Temperate Broadleaf and Mixed Forests	Sichuan Basin evergreen broadleaf forests	Photograph	1929	National Museum of Natural History USA
Non-melanistic 56	*japonensis*	Tai-Yuan-Fu, Shanxi, China	38,0998	113,3001	Temperate Broadleaf and Mixed Forests	Central China loess plateau mixed forests	Photograph	1910	National Museum of Natural History USA
Non-melanistic 57	*japonensis*	Tashenlu, Sichuan, China	29,5977	111,9222	Tropical and Subtropical Moist Broadleaf Forests	Guizhou Plateau broadleaf and mixed forests	Photograph	1930	National Museum of Natural History USA
Non-melanistic 58	*japonensis*	Tseo-Jia-Keo, Sichuan, China	29,1496	112,2255	Temperate Broadleaf and Mixed Forests	Changjiang Plain evergreen forests	Photograph	1931	National Museum of Natural History USA
Non-melanistic 59	*japonensis*	Wen Chuan, Sichuan, China	31,4709	103,5986	Temperate Coniferous Forest	Hengduan Shan conifer forests	Photograph	no data	National Museum of Natural History USA
Non-melanistic 60	*japonensis*	Yenping, Fukien Province, China	26,5698	118,5703	Tropical and Subtropical Moist Broadleaf Forests	Southeast China-Hainan moist forests	Photograph	1921	American Museum of Natural History USA
Non-melanistic 61	*japonensis*	Yochow, Hunan, China	28,1421	112,8030	Temperate Broadleaf and Mixed Forests	Changjiang Plain evergreen forests	Photograph	no data	National Museum of Natural History USA
Non-melanistic 62	*delacouri*	Yunnan National Nature Reserve, China	22,1923	101,3011	Tropical and Subtropical Moist Broadleaf Forests	North Indochina subtropical moist forests	Photograph	2008	Jutzeler et al 2010
Non-melanistic 63	*pardus*	Akenge, Congo	2,8334	27,1776	Tropical and Subtropical Moist Broadleaf Forests	Northeastern Congo Basin moist forests	Photograph	1913	American Museum of Natural History USA
Non-melanistic 64	*pardus*	Akenge, Congo	2,8724	27,2210	Tropical and Subtropical Moist Broadleaf Forests	Northeastern Congo Basin moist forests	Photograph	1913	American Museum of Natural History USA
Non-melanistic 65	*pardus*	Bwera, Congo	-0,8704	29,3107	Tropical and Subtropical Grasslands, Savannas and Shrublands	Victoria Basin forest-savanna mosaic	Photograph	2012	National Geographic Society
Non-melanistic 66	*pardus*	Congo River, Ngabe, Congo	-3,0253	16,1324	Tropical and Subtropical Grasslands, Savannas and Shrublands	Western Congolian forest-savanna mosaic	Photograph	no data	Philipp Henschel
Non-melanistic 67	*pardus*	Nouabalé-Ndoki National Park, Congo	2,4665	16,5519	Tropical and Subtropical Moist Broadleaf Forests	Western Congo Basin moist forests	Photograph	no data	Philipp Henschel
Non-melanistic 68	*pardus*	Bereket Girma Wildlife Rascue, Ethiopia	9,0639	38,5470	Montane Grasslands and Shrublands	Ethiopian Highlands	Photograph	2011	Stephen Brend
Non-melanistic 69	*pardus*	Haro, Abyssinia, Ethiopia	9,0104	34,7012	Tropical and Subtropical Moist Broadleaf Forests	Ethiopian montane forests	Photograph	no data	American Museum of Natural History USA
Non-melanistic 70	*pardus*	Ivindo National Park, Gabon	0,1768	12,9879	Tropical and Subtropical Moist Broadleaf Forests	Western Congo Basin moist forests	Photograph	2009	Philipp Henschel
Non-melanistic 71	*pardus*	Ivindo National Park, Gabon	0,1768	12,9879	Tropical and Subtropical Moist Broadleaf Forests	Western Congo Basin moist forests	Photograph	2009	Philipp Henschel
Non-melanistic 72	*pardus*	Ivindo National Park, Gabon	0,1768	12,9879	Tropical and Subtropical Moist Broadleaf Forests	Western Congo Basin moist forests	Photograph	2009	Philipp Henschel
Non-melanistic 73	*pardus*	Ivindo National Park, Gabon	-0,2699	12,7138	Tropical and Subtropical Moist Broadleaf Forests	Western Congo Basin moist forests	Photograph	no data	Philipp Henschel
Non-melanistic 74	*pardus*	Koulamoutou, Gabon	-0,9773	12,3016	Tropical and Subtropical Moist Broadleaf Forests	Western Congo Basin moist forests	Photograph	no data	Philipp Henschel
Non-melanistic 75	*pardus*	Lope National Park, Gabon	-0,2151	11,5191	Tropical and Subtropical Grasslands, Savannas and Shrublands	Western Congolian forest-savanna mosaic	Photograph	no data	Philipp Henschel
Non-melanistic 76	*pardus*	Lope National Park, Gabon	-0,2151	11,5191	Tropical and Subtropical Grasslands, Savannas and Shrublands	Western Congolian forest-savanna mosaic	Photograph	no data	Philipp Henschel
Non-melanistic 77	*pardus*	Lope National Park, Gabon	-0,5203	11,4897	Tropical and Subtropical Moist Broadleaf Forests	Congolian Coastal Forests	Photograph	no data	Philipp Henschel
Non-melanistic 78	*pardus*	Lope National Park, Gabon	-0,5203	11,4897	Tropical and Subtropical Moist Broadleaf Forests	Congolian Coastal Forests	Photograph	no data	Philipp Henschel
Non-melanistic 79	*pardus*	Lope National Park, Gabon	-0,6079	11,6042	Tropical and Subtropical Moist Broadleaf Forests	Congolian Coastal Forests	Photograph	no data	Philipp Henschel
Non-melanistic 80	*pardus*	Lope National Park, Gabon	-0,6606	11,5551	Tropical and Subtropical Moist Broadleaf Forests	Congolian Coastal Forests	Photograph	no data	Philipp Henschel
Non-melanistic 81	*pardus*	Lope National Park, Gabon	-0,1773	11,4754	Tropical and Subtropical Grasslands, Savannas and Shrublands	Western Congolian forest-savanna mosaic	Photograph	no data	Philipp Henschel
Non-melanistic 82	*pardus*	Lope National Park, Gabon	-0,3088	11,6332	Tropical and Subtropical Moist Broadleaf Forests	Congolian Coastal Forests	Photograph	no data	Philipp Henschel
Non-melanistic 83	*pardus*	Ogooue River, Kan Kan, Gabon	-0,0333	12,3136	Tropical and Subtropical Moist Broadleaf Forests	Western Congo Basin moist forests	Photograph	no data	Philipp Henschel
Non-melanistic 84	*pardus*	Ongongo, Gabon	1,3084	11,6978	Tropical and Subtropical Moist Broadleaf Forests	Congolian Coastal Forests	Photograph	no data	Philipp Henschel
Non-melanistic 85	*pardus*	Plateau Bateke National Park, Gabon	-2,2737	14,0952	Tropical and Subtropical Grasslands, Savannas and Shrublands	Western Congolian forest-savanna mosaic	Photograph	no data	Philipp Henschel
Non-melanistic 86	*saxicolor*	Vashlovani Reserve, Georgia	41,2115	46,4417	Deserts and Xeric Shrublands	Azerbaijan shrub desert and steppe	Photograph	no data	Asian Leopard Project
Non-melanistic 87	*pardus*	Mole National Park, Ghana	9,4323	-1,7133	Tropical and Subtropical Grasslands, Savannas and Shrublands	West Sudanian savanna	Photograph	no data	National Geographic Society
Non-melanistic 88	*pardus*	Mole National Park, Ghana	9,3845	-2,0271	Tropical and Subtropical Grasslands, Savannas and Shrublands	West Sudanian savanna	Photograph	no data	National Geographic Society
Non-melanistic 89	*fusca*	Achanakmar Tiger Reserve, India	22,5980	81,8327	Tropical and Subtropical Moist Broadleaf Forests	Eastern highlands moist deciduous forests	Photograph	no data	Vidya Atreya
Non-melanistic 90	*fusca*	Achanakmar Tiger Reserve, India	22,4232	81,7286	Tropical and Subtropical Moist Broadleaf Forests	Eastern highlands moist deciduous forests	Photograph	no data	Vidya Atreya
Non-melanistic 91	*fusca*	Akola/Rajur, India	19,5507	73,9639	Deserts and Xeric Shrublands	Deccan thorn scrub forests	Photograph	no data	Vidya Atreya
Non-melanistic 92	*fusca*	Akole, India	19,3109	73,4020	Tropical and Subtropical Moist Broadleaf Forests	North Western Ghats montane rain forests	Photograph	2012	Vidya Atreya
Non-melanistic 93	*fusca*	Akole, India	19,3258	73,3799	Tropical and Subtropical Moist Broadleaf Forests	North Western Ghats montane rain forests	Photograph	2012	Vidya Atreya
Non-melanistic 94	*fusca*	Anamalai Hills, Southern Western Ghats, India	12,1058	78,9328	Tropical and Subtropical Dry Broadleaf Forests	South Deccan Plateau dry deciduous forests	Photograph	no data	World Wild Fund
Non-melanistic 95	*fusca*	Bagdodra, Haskhowa, India	26,7458	88,2892	Tropical and Subtropical Moist Broadleaf Forests	Himalayan subtropical broadleaf forests	Photograph	2012	World Wild Fund
Non-melanistic 96	*fusca*	Bandipur Tiger Reserve, India	11,6407	76,4442	Tropical and Subtropical Moist Broadleaf Forests	Southwestern Ghats moist forest	Photograph	2013	Wildlife Conservation Society
Non-melanistic 97	*fusca*	Bhadra Tiger Reserve, India	13,6071	75,5910	Tropical and Subtropical Moist Broadleaf Forests	North Western Ghats moist deciduous forests	Photograph	no data	Vidya Atreya
Non-melanistic 98	*fusca*	Bhadra Tiger Reserve, India	13,5380	75,5222	Tropical and Subtropical Moist Broadleaf Forests	North Western Ghats moist deciduous forests	Photograph	2011	Conservation India
Non-melanistic 99	*fusca*	Bhadra Tiger Reserve, India	13,6189	75,6286	Tropical and Subtropical Moist Broadleaf Forests	North Western Ghats moist deciduous forests	Photograph	2012	Conservation India
Non-melanistic 100	*fusca*	Dahra Dan, India	30,3872	78,1732	Tropical and Subtropical Moist Broadleaf Forests	Upper Gangetic Plains moist deciduous forests	Photograph	no data	Goyal 2009
Non-melanistic 101	*fusca*	Dandeli-Anshi Tiger Reserve, India	13,1213	75,0433	Tropical and Subtropical Moist Broadleaf Forests	Malabar Coast moist forests	Photograph	2013	Wildlife Conservation Society
Non-melanistic 102	*fusca*	Dandeli-Anshi Tiger Reserve, India	13,1213	75,0433	Tropical and Subtropical Moist Broadleaf Forests	Malabar Coast moist forests	Photograph	2013	Wildlife Conservation Society
Non-melanistic 103	*fusca*	Dehing Patkai Wildlife Sanctuary, India	26,4451	93,5389	Tropical and Subtropical Moist Broadleaf Forests	Meghalaya subtropical forests	Photograph	2009	Dipankar Ghose
Non-melanistic 104	*fusca*	Dudhwa National Park, India	27,4659	79,7461	Tropical and Subtropical Moist Broadleaf Forests	Upper Gangetic Plains moist deciduous forests	Photograph	no data	World Wild Fund
Non-melanistic 105	*fusca*	Dudhwa National Park, India	27,2008	79,8949	Tropical and Subtropical Moist Broadleaf Forests	Upper Gangetic Plains moist deciduous forests	Photograph	no data	World Wild Fund
Non-melanistic 106	*fusca*	Dudhwa National Park, India	27,9333	81,3510	Tropical and Subtropical Moist Broadleaf Forests	Upper Gangetic Plains moist deciduous forests	Photograph	no data	World Wild Fund
Non-melanistic 107	*fusca*	Garhwal Western Himalaya, India	30,5542	79,3165	Montane Grasslands and Shrublands	Western Himalayan alpine shrub and Meadows	Photograph	2008	World Wild Fund
Non-melanistic 108	*fusca*	Gir Forest National Park, India	21,2057	71,1518	Tropical and Subtropical Dry Broadleaf Forests	Khathiar-Gir dry deciduous forests	Photograph	no data	Singh 2005
Non-melanistic 109	*fusca*	Gir Forest National Park, India	21,2721	71,1679	Tropical and Subtropical Dry Broadleaf Forests	Khathiar-Gir dry deciduous forests	Photograph	no data	Smithsonian Institution
Non-melanistic 110	*fusca*	Guwahati, India	26,1208	91,7107	Tropical and Subtropical Moist Broadleaf Forests	Meghalaya subtropical forests	Photograph	no data	Dipankar Ghose
Non-melanistic 111	*fusca*	Haraicha, Mavatuv, India	30,7922	76,1306	Deserts and Xeric Shrublands	Northwestern thorn scrub forests	Photograph	1936	American Museum of Natural History USA
Non-melanistic 112	*fusca*	Haridwar, Rajaji National Park Chila Range, India	30,0489	78,3142	Tropical and Subtropical Moist Broadleaf Forests	Upper Gangetic Plains moist deciduous forests	Photograph	no data	Smithsonian Institution

Id	Subspecies	Location	Deg. - WGS84		Biome	Ecorregion	Sample	Year	Source
			Latitude	Longitude					
Non-melanistic 113	*fusca*	Hyhama, Jammu And Kashmir, India	33,9766	77,4887	Montane Grasslands and Shrublands	Tibetan Plateau steppe	Photograph	1911	National Museum of Natural History USA
Non-melanistic 114	*fusca*	Hyhama, Jammu And Kashmir, India	33,6569	77,7122	Montane Grasslands and Shrublands	Tibetan Plateau steppe	Photograph	1911	National Museum of Natural History USA
Non-melanistic 115	*fusca*	Jeypore-Dehing Area, India	27,1370	95,3860	Tropical and Subtropical Moist Broadleaf Forests	Brahmaputra Valley semi-evergreen forests	Photograph	no data	Kashmira Kakati
Non-melanistic 116	*fusca*	Jeypore-Dehing Area, India	27,1370	95,3860	Tropical and Subtropical Moist Broadleaf Forests	Brahmaputra Valley semi-evergreen forests	Photograph	no data	Kashmira Kakati
Non-melanistic 117	*fusca*	Jeypore-Dehing Area, India	27,1370	95,3860	Tropical and Subtropical Moist Broadleaf Forests	Brahmaputra Valley semi-evergreen forests	Photograph	no data	Kashmira Kakati
Non-melanistic 118	*fusca*	Jeypore-Dehing Area, India	27,0584	95,5366	Tropical and Subtropical Moist Broadleaf Forests	Brahmaputra Valley semi-evergreen forests	Photograph	no data	Kashmira Kakati
Non-melanistic 119	*fusca*	Jeypore-Dehing Area, India	27,2488	95,5193	Tropical and Subtropical Moist Broadleaf Forests	Brahmaputra Valley semi-evergreen forests	Photograph	no data	Kashmira Kakati
Non-melanistic 120	*fusca*	Jeypore-Dehing Area, India	27,2488	95,5193	Tropical and Subtropical Moist Broadleaf Forests	Brahmaputra Valley semi-evergreen forests	Photograph	no data	Kashmira Kakati
Non-melanistic 121	*fusca*	Jeypore-Dehing Area, India	27,6499	95,4474	Tropical and Subtropical Moist Broadleaf Forests	Brahmaputra Valley semi-evergreen forests	Photograph	no data	Kashmira Kakati
Non-melanistic 122	*fusca*	Jeypore-Dehing Area, India	27,1285	95,8475	Temperate Broadleaf and Mixed Forests	Eastern Himalayan broadleaf forests	Photograph	no data	Kashmira Kakati
Non-melanistic 123	*fusca*	Jeypore-Dehing Area, India	27,1285	95,8475	Temperate Broadleaf and Mixed Forests	Eastern Himalayan broadleaf forests	Photograph	no data	Kashmira Kakati
Non-melanistic 124	*fusca*	Jeypore-Dehing Area, India	27,2331	95,6986	Tropical and Subtropical Moist Broadleaf Forests	Brahmaputra Valley semi-evergreen forests	Photograph	no data	Kashmira Kakati
Non-melanistic 125	*fusca*	Jeypore-Dehing Area, India	27,2331	95,6986	Tropical and Subtropical Moist Broadleaf Forests	Brahmaputra Valley semi-evergreen forests	Photograph	no data	Kashmira Kakati
Non-melanistic 126	*fusca*	Jeypore-Dehing Area, India	27,3618	95,7520	Tropical and Subtropical Moist Broadleaf Forests	Brahmaputra Valley semi-evergreen forests	Photograph	no data	Kashmira Kakati
Non-melanistic 127	*fusca*	Jeypore-Dehing Area, India	27,3618	95,7520	Tropical and Subtropical Moist Broadleaf Forests	Brahmaputra Valley semi-evergreen forests	Photograph	no data	Kashmira Kakati
Non-melanistic 128	*fusca*	Jeypore-Dehing Area, India	27,4243	95,7601	Tropical and Subtropical Moist Broadleaf Forests	Brahmaputra Valley semi-evergreen forests	Photograph	no data	Kashmira Kakati
Non-melanistic 129	*fusca*	Jeypore-Dehing Area, India	27,4243	95,7601	Tropical and Subtropical Moist Broadleaf Forests	Brahmaputra Valley semi-evergreen forests	Photograph	no data	Kashmira Kakati
Non-melanistic 130	*fusca*	Jeypore-Dehing Area, India	27,5402	95,7905	Tropical and Subtropical Moist Broadleaf Forests	Brahmaputra Valley semi-evergreen forests	Photograph	no data	Kashmira Kakati
Non-melanistic 131	*fusca*	Jeypore-Dehing Area, India	27,5402	95,7905	Tropical and Subtropical Moist Broadleaf Forests	Brahmaputra Valley semi-evergreen forests	Photograph	no data	Kashmira Kakati
Non-melanistic 132	*fusca*	Jeypore-Dehing Area, India	27,5402	95,7905	Tropical and Subtropical Moist Broadleaf Forests	Brahmaputra Valley semi-evergreen forests	Photograph	no data	Kashmira Kakati
Non-melanistic 133	*fusca*	Kabini, Bandipur, India	34,1378	75,0364	Temperate Broadleaf and Mixed Forests	Western Himalayan broadleaf forests	Photograph	no data	Vidya Atreya
Non-melanistic 134	*fusca*	Karnataka, India	12,8232	76,0097	Tropical and Subtropical Moist Broadleaf Forests	North Western Ghats moist deciduous forests	Photograph	2013	World Wild Fund
Non-melanistic 135	*fusca*	Kanavde, India	19,5468	74,0299	Deserts and Xeric Shrublands	Deccan thorn scrub forests	Photograph	no data	Vidya Atreya
Non-melanistic 136	*fusca*	Kanha Tiger Reserve, Madhya Pradesh, India	23,2809	80,4837	Tropical and Subtropical Moist Broadleaf Forests	Eastern Deccan plateau moist forests	Photograph	no data	Christoph Knogge
Non-melanistic 137	*fusca*	Kanha Tiger Reserve, Madhya Pradesh, India	23,0263	80,7801	Tropical and Subtropical Moist Broadleaf Forests	Eastern Deccan plateau moist forests	Photograph	2013	Sandeep Sharma
Non-melanistic 138	*fusca*	Knagar, India	19,5177	74,0293	Deserts and Xeric Shrublands	Deccan thorn scrub forests	Photograph	no data	Vidya Atreya
Non-melanistic 139	*fusca*	Kormar Gudda, India	22,9019	81,1676	Tropical and Subtropical Moist Broadleaf Forests	Eastern Deccan plateau moist forests	Photograph	no data	Kashmira Kakati
Non-melanistic 140	*fusca*	Kundur, India	23,4147	80,7939	Tropical and Subtropical Moist Broadleaf Forests	Eastern Deccan plateau moist forests	Photograph	no data	Kashmira Kakati
Non-melanistic 141	*fusca*	Kupwara Forest, India	34,5811	74,3511	Temperate Broadleaf and Mixed Forests	Western Himalayan broadleaf forests	Photograph	no data	Kashmira Kakati
Non-melanistic 142	*fusca*	Madras, Mavatuv, India	31,4190	76,5938	Tropical and Subtropical Coniferous Forests	Himalayan subtropical pine forests	Photograph	1936	American Museum of Natural History USA
Non-melanistic 143	*fusca*	Mundanthurai Sanctuary, India	8,7603	77,2816	Tropical and Subtropical Moist Broadleaf Forests	Southwestern Ghats moist forest	Photograph	no data	Christoph Knogge
Non-melanistic 144	*fusca*	Mundanthurai Sanctuary, India	8,7252	77,2885	Tropical and Subtropical Moist Broadleaf Forests	Southwestern Ghats moist forest	Photograph	no data	Christoph Knogge
Non-melanistic 145	*fusca*	Nagarjunasagar Srisailam Tiger Reserve, india	16,4090	79,2564	Tropical and Subtropical Dry Broadleaf Forests	Central Deccan Plateau dry deciduous forests	Photograph	2011	World Wild Fund
Non-melanistic 146	*fusca*	Naimeri National Park, India	26,9456	92,7525	Tropical and Subtropical Moist Broadleaf Forests	Brahmaputra Valley semi-evergreen forests	Photograph	2011	World Wild Fund
Non-melanistic 147	*fusca*	Pauri Garhwal, India	29,8702	78,9477	Tropical and Subtropical Coniferous Forests	Himalayan subtropical pine forests	Photograph	no data	Goyal 2009
Non-melanistic 148	*fusca*	Pakke Tiger Reserve in Arunachal Pradesh, India	28,5669	95,9691	Temperate Broadleaf and Mixed Forests	Eastern Himalayan broadleaf forests	Photograph	2013	Milind Pariwakam/Biswajit Mohanty
Non-melanistic 149	*fusca*	Philibit, India	28,6421	79,9662	Tropical and Subtropical Moist Broadleaf Forests	Upper Gangetic Plains moist deciduous forests	Photograph	2010	World Wild Fund
Non-melanistic 150	*fusca*	Pilibhit, India	28,6355	79,8480	Tropical and Subtropical Moist Broadleaf Forests	Upper Gangetic Plains moist deciduous forests	Photograph	2010	World Wild Fund
Non-melanistic 151	*fusca*	Sanaripur, India	30,0183	77,5406	Tropical and Subtropical Moist Broadleaf Forests	Upper Gangetic Plains moist deciduous forests	Photograph	1923	American Museum of Natural History USA
Non-melanistic 152	*fusca*	Sanaripur, India	30,0183	77,5406	Tropical and Subtropical Moist Broadleaf Forests	Upper Gangetic Plains moist deciduous forests	Photograph	1923	American Museum of Natural History USA
Non-melanistic 153	*fusca*	Sanaripur, India	29,9502	77,5913	Tropical and Subtropical Moist Broadleaf Forests	Upper Gangetic Plains moist deciduous forests	Photograph	1923	American Museum of Natural History USA
Non-melanistic 154	*fusca*	Sanjay Gandhi National Park, India	19,2325	72,9024	Tropical and Subtropical Moist Broadleaf Forests	Malabar Coast moist forests	Photograph	2012	Conservation India
Non-melanistic 155	*fusca*	Sanjay Gandhi National Park, India	19,2141	72,9253	Tropical and Subtropical Moist Broadleaf Forests	Malabar Coast moist forests	Photograph	2013	Conservation India
Non-melanistic 156	*fusca*	Sanjay Gandhi National Park, India	19,1726	72,8914	Tropical and Subtropical Moist Broadleaf Forests	Malabar Coast moist forests	Photograph	2013	Conservation India
Non-melanistic 157	*fusca*	Sanjay Gandhi National Park, India	19,1726	72,8914	Tropical and Subtropical Moist Broadleaf Forests	Malabar Coast moist forests	Photograph	2013	Conservation India
Non-melanistic 158	*fusca*	Sariska Tiger Reserve, India	27,4076	76,7404	Tropical and Subtropical Dry Broadleaf Forests	Khathiar-Gir dry deciduous forests	Photograph	no data	National Geographic Society
Non-melanistic 159	*fusca*	Sariska Tiger Reserve, India	27,3019	76,7276	Tropical and Subtropical Dry Broadleaf Forests	Khathiar-Gir dry deciduous forests	Photograph	no data	National Geographic Society
Non-melanistic 160	*fusca*	Sariska Tiger Reserve, India	27,2146	76,4171	Tropical and Subtropical Dry Broadleaf Forests	Khathiar-Gir dry deciduous forests	Photograph	no data	Chauhan et al 2005
Non-melanistic 161	*fusca*	Sariska Tiger Reserve, India	27,2146	76,4171	Tropical and Subtropical Dry Broadleaf Forests	Khathiar-Gir dry deciduous forests	Photograph	no data	Chauhan et al 2006
Non-melanistic 162	*fusca*	Sariska Tiger Reserve, India	27,2426	76,3155	Tropical and Subtropical Dry Broadleaf Forests	Khathiar-Gir dry deciduous forests	Photograph	no data	Chauhan et al 2007
Non-melanistic 163	*fusca*	Sariska Tiger Reserve, India	27,1166	76,2561	Tropical and Subtropical Dry Broadleaf Forests	Khathiar-Gir dry deciduous forests	Photograph	no data	Chauhan et al 2008
Non-melanistic 164	*fusca*	Sariska Tiger Reserve, India	27,3059	76,4886	Tropical and Subtropical Dry Broadleaf Forests	Khathiar-Gir dry deciduous forests	Photograph	no data	Chauhan et al 2009
Non-melanistic 165	*fusca*	Shivaji, India	19,5854	73,9862	Deserts and Xeric Shrublands	Deccan thorn scrub forests	Photograph	no data	Vidya Atreya
Non-melanistic 166	*fusca*	Siliguri, Prakash Nagar, India	26,8001	88,4827	Tropical and Subtropical Grasslands, Savannas and Shrublands	Terai-Duar savanna and grasslands	Photograph	2011	Vidya Atreya
Non-melanistic 167	*fusca*	Tadoba Andhari Tiger Reserve, Maharashtra, India	20,2085	79,5276	Tropical and Subtropical Dry Broadleaf Forests	Central Deccan Plateau dry deciduous forests	Photograph	no data	Vidya Atreya
Non-melanistic 168	*fusca*	Talewadi, India	19,5107	73,9672	Deserts and Xeric Shrublands	Deccan thorn scrub forests	Photograph	no data	Vidya Atreya
Non-melanistic 169	*fusca*	Uttarakhand, India	30,0002	80,2295	Temperate Broadleaf and Mixed Forests	Western Himalayan broadleaf forests	Photograph	no data	Goyal 2009
Non-melanistic 170	*fusca*	Uttarakhand, India	30,3109	79,6338	Montane Grasslands and Shrublands	Western Himalayan alpine shrub and Meadows	Photograph	no data	Goyal 2009
Non-melanistic 171	*fusca*	Uttarakhand, India	30,4446	79,6386	Montane Grasslands and Shrublands	Western Himalayan alpine shrub and Meadows	Photograph	no data	Goyal 2009
Non-melanistic 172	*fusca*	Uttarakhand, India	29,9234	79,6530	Tropical and Subtropical Coniferous Forests	Himalayan subtropical pine forests	Photograph	no data	Goyal 2009
Non-melanistic 173	*fusca*	Uttaranchal, India	30,3076	80,1796	Montane Grasslands and Shrublands	Western Himalayan alpine shrub and Meadows	Photograph	no data	Marker & Sivamani 2009

Id	Subspecies	Location	Deg. - WGS84		Biome	Ecorregion	Sample	Year	Source
			Latitude	Longitude					
Non-melanistic 174	*fusca*	Vitbhatti, India	19,5298	74,0396	Deserts and Xeric Shrublands	Deccan thorn scrub forests	Photograph	no data	Vidya Atreya
Non-melanistic 175	*melas*	Baluran National Park, Java, Indonesia	-7,8044	114,3797	Tropical and Subtropical Moist Broadleaf Forests	Eastern Java-Bali rain forests	Photograph	2012	Copenhague Zoo
Non-melanistic 176	*melas*	Baluran National Park, Java, Indonesia	-7,8878	114,3786	Tropical and Subtropical Moist Broadleaf Forests	Eastern Java-Bali rain forests	Photograph	2012	Copenhague Zoo
Non-melanistic 177	*melas*	Bengkung, Java, Indonesia	-6,7706	106,4565	Tropical and Subtropical Moist Broadleaf Forests	Western Java rain forests	Photograph	no data	WildCru
Non-melanistic 178	*melas*	Gunung Salak National Park, Java, Indonesia	-7,2547	107,4355	Tropical and Subtropical Moist Broadleaf Forests	Western Java rain forests	Photograph	no data	CIFOR
Non-melanistic 179	*melas*	Halimun-Salak, Java, Indonesia	-6,7847	106,5780	Tropical and Subtropical Moist Broadleaf Forests	Western Java rain forests	Photograph	2004	Anhar Harahap
Non-melanistic 180	*melas*	Mount Halimun-Salak National Park, Java, Indonesia	-7,1029	107,3755	Tropical and Subtropical Moist Broadleaf Forests	Western Java rain forests	Photograph	no data	CIFOR
Non-melanistic 181	*melas*	Pelaboean Ratoe, Java, Indonesia	-6,9882	106,5549	Tropical and Subtropical Moist Broadleaf Forests	Western Java rain forests	Photograph	1909	National Museum of Natural History USA
Non-melanistic 182	*melas*	Ujung Kulon National Park, Java, Indonesia	-6,7339	105,3438	Tropical and Subtropical Moist Broadleaf Forests	Western Java rain forests	Photograph	no data	WildCru
Non-melanistic 183	*saxicolor*	Alborz Mountains, Iran	36,4611	51,4824	Temperate Broadleaf and Mixed Forests	Caspian Hyrcanian mixed forests	Photograph	no data	Farhadinia et al 2007
Non-melanistic 184	*saxicolor*	Bafq, Iran	31,8150	55,2717	Deserts and Xeric Shrublands	Central Persian desert basins	Photograph	2012	Asian Leopard Project
Non-melanistic 185	*saxicolor*	Bafq, Iran	31,7713	55,3136	Deserts and Xeric Shrublands	Central Persian desert basins	Photograph	2013	Panthera
Non-melanistic 186	*saxicolor*	Bafq, Iran	31,7713	55,3136	Deserts and Xeric Shrublands	Central Persian desert basins	Photograph	2013	Panthera
Non-melanistic 187	*saxicolor*	Bafq, Iran	32,2349	55,4353	Deserts and Xeric Shrublands	Central Persian desert basins	Photograph	2013	Panthera
Non-melanistic 188	*saxicolor*	Bafq, Iran	32,2349	55,4353	Deserts and Xeric Shrublands	Central Persian desert basins	Photograph	2013	Panthera
Non-melanistic 189	*saxicolor*	Bafq, Iran	31,6719	55,0649	Deserts and Xeric Shrublands	Central Persian desert basins	Photograph	2013	Panthera
Non-melanistic 190	*saxicolor*	Bamu National Park, Iran	29,6579	53,1614	Temperate Broadleaf and Mixed Forests	Zagros Mountains forest steppe	Photograph	no data	Arash Ghoddousi
Non-melanistic 191	*saxicolor*	Bamu National Park, Iran	29,8867	52,9034	Temperate Broadleaf and Mixed Forests	Zagros Mountains forest steppe	Photograph	no data	Arash Ghoddousi
Non-melanistic 192	*saxicolor*	Bamu National Park, Iran	29,8339	52,9008	Temperate Broadleaf and Mixed Forests	Zagros Mountains forest steppe	Photograph	no data	Arash Ghoddousi
Non-melanistic 193	*saxicolor*	Bamu National Park, Iran	29,8853	52,9552	Temperate Broadleaf and Mixed Forests	Zagros Mountains forest steppe	Photograph	no data	Arash Ghoddousi
Non-melanistic 194	*saxicolor*	Bamu National Park, Iran	29,8853	52,9552	Temperate Broadleaf and Mixed Forests	Zagros Mountains forest steppe	Photograph	no data	Arash Ghoddousi
Non-melanistic 195	*saxicolor*	Bamu National Park, Iran	29,8853	52,9552	Temperate Broadleaf and Mixed Forests	Zagros Mountains forest steppe	Photograph	no data	Arash Ghoddousi
Non-melanistic 196	*saxicolor*	Bamu National Park, Iran	29,8853	52,9552	Temperate Broadleaf and Mixed Forests	Zagros Mountains forest steppe	Photograph	no data	Arash Ghoddousi
Non-melanistic 197	*saxicolor*	Bamu National Park, Iran	29,8853	52,9552	Temperate Broadleaf and Mixed Forests	Zagros Mountains forest steppe	Photograph	no data	Arash Ghoddousi
Non-melanistic 198	*saxicolor*	Bamu National Park, Iran	29,8150	52,9750	Temperate Broadleaf and Mixed Forests	Zagros Mountains forest steppe	Photograph	no data	Arash Ghoddousi
Non-melanistic 199	*saxicolor*	Bandar-Gaz, Iran	26,6795	55,0549	Deserts and Xeric Shrublands	South Iran Nubo-Sindian desert and semi-desert	Photograph	no data	Asian Leopard Project
Non-melanistic 200	*saxicolor*	Birk Protected Area, Iran	29,6558	58,3126	Deserts and Xeric Shrublands	South Iran Nubo-Sindian desert and semi-desert	Photograph	no data	Asian Leopard Project
Non-melanistic 201	*saxicolor*	Birk Protected Area, Iran	29,5872	58,3913	Deserts and Xeric Shrublands	South Iran Nubo-Sindian desert and semi-desert	Photograph	no data	Asian Leopard Project
Non-melanistic 202	*saxicolor*	Dargaz, Khorasan Province, Iran	36,9854	58,6955	Deserts and Xeric Shrublands	Central Persian desert basins	Photograph	no data	Asian Leopard Project
Non-melanistic 203	*saxicolor*	Ghorkhod & Behkadeh Reserve, Iran	37,6015	56,5290	Temperate Broadleaf and Mixed Forests	Caucasus-Anatolian-Hyrcanian temperate forests	Photograph	no data	Farhadinia et al 2007
Non-melanistic 204	*saxicolor*	Golestan National Park, Iran	38,0852	56,4868	Montane Grasslands and Shrublands	Kopet Dag woodlands and forest steppe	Photograph	no data	Asian Leopard Project
Non-melanistic 205	*saxicolor*	Gorgan-Golestan, Iran	37,2019	54,6584	Deserts and Xeric Shrublands	Caspian lowland desert	Photograph	no data	Asian Leopard Project
Non-melanistic 206	*saxicolor*	Gorgan-Golestan, Iran	37,2709	54,3942	Deserts and Xeric Shrublands	Caspian lowland desert	Photograph	no data	Asian Leopard Project
Non-melanistic 207	*saxicolor*	Gouladah, Bujnurd, Iran	37,4797	57,2698	Deserts and Xeric Shrublands	Central Persian desert basins	Photograph	1938	American Museum of Natural History USA
Non-melanistic 208	*saxicolor*	Kerman, Iran	30,3739	57,3553	Montane Grasslands and Shrublands	Kuh Rud and Eastern Iran montane woodlands	Photograph	no data	Asian Leopard Project
Non-melanistic 209	*saxicolor*	Khaeez Area, Iran	28,7051	51,5107	Deserts and Xeric Shrublands	South Iran Nubo-Sindian desert and semi-desert	Photograph	no data	Abdoli et al 2008
Non-melanistic 210	*saxicolor*	Khojir National Park, Iran	35,5963	51,8186	Deserts and Xeric Shrublands	Central Persian desert basins	Photograph	no data	Asian Leopard Project
Non-melanistic 211	*saxicolor*	Khorasan Province, Iran	35,8595	60,1116	Deserts and Xeric Shrublands	Central Persian desert basins	Photograph	no data	Asian Leopard Project
Non-melanistic 212	*saxicolor*	Khorasan Province, Iran	33,2073	60,3131	Montane Grasslands and Shrublands	Kuh Rud and Eastern Iran montane woodlands	Photograph	no data	Asian Leopard Project
Non-melanistic 213	*saxicolor*	Khorasan Province, Iran	35,5268	59,2535	Montane Grasslands and Shrublands	Kuh Rud and Eastern Iran montane woodlands	Photograph	no data	Asian Leopard Project
Non-melanistic 214	*saxicolor*	Khorasan Province, Iran	34,2792	58,7812	Deserts and Xeric Shrublands	Central Persian desert basins	Photograph	no data	Asian Leopard Project
Non-melanistic 215	*saxicolor*	Khorasan Province, Iran	33,1146	59,2725	Montane Grasslands and Shrublands	Kuh Rud and Eastern Iran montane woodlands	Photograph	no data	Asian Leopard Project
Non-melanistic 216	*saxicolor*	Khorasan Province, Iran	35,6120	58,3048	Montane Grasslands and Shrublands	Kuh Rud and Eastern Iran montane woodlands	Photograph	no data	Asian Leopard Project
Non-melanistic 217	*saxicolor*	Khosh, Semnan Province, Iran	35,5550	55,3459	Deserts and Xeric Shrublands	Central Persian desert basins	Photograph	no data	Asian Leopard Project
Non-melanistic 218	*saxicolor*	Kiamaki Wildlife Reserve, Iran	38,7594	45,8547	Temperate Grasslands, Savannas and Shrublands	Eastern Anatolian montane steppe	Photograph	no data	Asian Leopard Project
Non-melanistic 219	*saxicolor*	Laristan, Bariz, Iran	33,5913	49,1922	Temperate Broadleaf and Mixed Forests	Zagros Mountains forest steppe	Photograph	1963	National Museum of Natural History USA
Non-melanistic 220	*saxicolor*	Laristan, Fars, Iran	33,3084	49,2420	Temperate Broadleaf and Mixed Forests	Zagros Mountains forest steppe	Photograph	1963	National Museum of Natural History USA
Non-melanistic 221	*saxicolor*	Mazandaran, Iran	36,3078	52,1673	Temperate Broadleaf and Mixed Forests	Caspian Hyrcanian mixed forests	Photograph	no data	Asian Leopard Project
Non-melanistic 222	*saxicolor*	Mazandaran, Iran	36,3296	53,0279	Temperate Broadleaf and Mixed Forests	Caspian Hyrcanian mixed forests	Photograph	no data	Asian Leopard Project
Non-melanistic 223	*saxicolor*	Neishabour, Khorasan Province, Iran	36,2544	58,8633	Temperate Coniferous Forest	Caucasus-Anatolian-Hyrcanian temperate forests	Photograph	no data	Asian Leopard Project
Non-melanistic 224	*saxicolor*	North Khorasan, Iran	35,8884	58,6493	Deserts and Xeric Shrublands	Central Persian desert basins	Photograph	2012	Asian Leopard Project
Non-melanistic 225	*saxicolor*	Qualanlu, Iran	37,5376	56,4123	Temperate Coniferous Forest	Caucasus-Anatolian-Hyrcanian temperate forests	Photograph	2013	Andrew Stein
Non-melanistic 226	*saxicolor*	Qualanlu, Iran	37,5425	56,1588	Temperate Broadleaf and Mixed Forests	Caspian Hyrcanian mixed forests	Photograph	2013	Andrew Stein
Non-melanistic 227	*saxicolor*	Sarigol National Park, Iran	37,8396	57,0308	Montane Grasslands and Shrublands	Kopet Dag woodlands and forest steppe	Photograph	2007	Farhadinia et al 2010
Non-melanistic 228	*saxicolor*	Sarigol National Park, Iran	37,8784	56,6037	Montane Grasslands and Shrublands	Kopet Dag woodlands and forest steppe	Photograph	2007	Farhadinia et al 2010
Non-melanistic 229	*saxicolor*	Talysh Mountains, Iran	38,8721	46,3442	Temperate Grasslands, Savannas and Shrublands	Eastern Anatolian montane steppe	Photograph	2007	Lukarevsky et al 2007
Non-melanistic 230	*saxicolor*	Tandoureh National Park, Iran	37,2770	58,4683	Montane Grasslands and Shrublands	Kopet Dag woodlands and forest steppe	Photograph	no data	Sayed Babak
Non-melanistic 231	*pardus*	Cheranganghi Hills, Kenya	-1,4972	36,6726	Tropical and Subtropical Grasslands, Savannas and Shrublands	East African Acacia Savannas	Photograph	no data	American Museum of Natural History USA
Non-melanistic 232	*pardus*	Cheranganghi Hills, Kenya	-1,6135	36,7174	Tropical and Subtropical Grasslands, Savannas and Shrublands	East African Acacia Savannas	Photograph	no data	American Museum of Natural History USA
Non-melanistic 233	*pardus*	Elgeyo Forest, Kenya	1,0730	35,2871	Tropical and Subtropical Moist Broadleaf Forests	East African montane forests	Photograph	no data	American Museum of Natural History USA
Non-melanistic 234	*pardus*	Endau, Kenya	-1,3345	38,6644	Tropical and Subtropical Grasslands, Savannas and Shrublands	East African Acacia Savannas	Photograph	no data	Smithsonian Institution

Id	Subspecies	Location	Deg. - WGS84		Biome	Ecorregion	Sample	Year	Source
			Latitude	Longitude					
Non-melanistic 235	*pardus*	Ewaso Lions Camp, Kenya	-1,4226	36,8473	Tropical and Subtropical Grasslands, Savannas and Shrublands	East African Acacia Savannas	Photograph	no data	Phillip Henschel
Non-melanistic 236	*pardus*	Guaso Ngishu Plateau, Kenya	-1,1088	36,5234	Tropical and Subtropical Grasslands, Savannas and Shrublands	East African Acacia Savannas	Photograph	1909	National Museum of Natural History USA
Non-melanistic 237	*pardus*	Kampi Moto, Nakuru, Kenya	-0,4294	36,1020	Tropical and Subtropical Grasslands, Savannas and Shrublands	East African Acacia Savannas	Photograph	1909	National Museum of Natural History USA
Non-melanistic 238	*pardus*	Lake Naivasha, Kenya	-0,6986	36,3578	Tropical and Subtropical Grasslands, Savannas and Shrublands	East African Acacia Savannas	Photograph	1909	National Museum of Natural History USA
Non-melanistic 239	*pardus*	Lake Naivasha, S End, Kenya	-0,8683	36,2074	Tropical and Subtropical Grasslands, Savannas and Shrublands	East African Acacia Savannas	Photograph	1909	National Museum of Natural History USA
Non-melanistic 240	*pardus*	Masai Mara Game Reserve, Kenya	-1,4803	35,1052	Tropical and Subtropical Grasslands, Savannas and Shrublands	East African Acacia Savannas	Photograph	no data	Smithsonian Institution
Non-melanistic 241	*pardus*	Magadi, Kenya	-1,7446	36,3396	Tropical and Subtropical Grasslands, Savannas and Shrublands	East African Acacia Savannas	Photograph	2010	Smithsonian Institution
Non-melanistic 242	*pardus*	Magadi, Kenya	-1,7837	36,3508	Tropical and Subtropical Grasslands, Savannas and Shrublands	East African Acacia Savannas	Photograph	2010	Smithsonian Institution
Non-melanistic 243	*pardus*	Masai Mara National Park, Kenya	-1,2992	34,8167	Tropical and Subtropical Moist Broadleaf Forests	East African montane forests	Photograph	no data	Phillip Henschel
Non-melanistic 244	*pardus*	Masai Mara National Park, Kenya	-1,6613	35,3135	Tropical and Subtropical Grasslands, Savannas and Shrublands	East African Acacia Savannas	Photograph	no data	Phillip Henschel
Non-melanistic 245	*pardus*	Masai Mara National Park, Kenya	-1,4010	34,8578	Tropical and Subtropical Grasslands, Savannas and Shrublands	East African Acacia Savannas	Photograph	no data	Phillip Henschel
Non-melanistic 246	*pardus*	Mount Kenya's, Kenya	-0,3075	37,5967	Tropical and Subtropical Grasslands, Savannas and Shrublands	East African Acacia Savannas	Photograph	no data	Smithsonian Institution
Non-melanistic 247	*pardus*	Mount Kenya's, Kenya	0,0003	37,6178	Tropical and Subtropical Moist Broadleaf Forests	East African montane forests	Photograph	no data	Smithsonian Institution
Non-melanistic 248	*pardus*	Ol Pejeta Kenya’s Laikipia District, Kenya	0,1262	36,8511	Tropical and Subtropical Grasslands, Savannas and Shrublands	East African Acacia Savannas	Photograph	no data	Smithsonian Institution
Non-melanistic 249	*pardus*	South Samburu, Kenya	-3,6851	39,2473	Tropical and Subtropical Grasslands, Savannas and Shrublands	East African Acacia Savannas	Photograph	no data	Phillip Henschel
Non-melanistic 250	*pardus*	Samburu Natural Reserve, Kenya	1,0857	38,2465	Deserts and Xeric Shrublands	Masai xeric grasslands and shrublands	Photograph	no data	Andrew Stein
Non-melanistic 251	*pardus*	Selenkay Safari Camp, Kenya	-0,4115	36,0993	Tropical and Subtropical Grasslands, Savannas and Shrublands	East African Acacia Savannas	Photograph	no data	Andrew Stein
Non-melanistic 252	*pardus*	Shaba National Reserve, Kenya	0,5476	37,2778	Tropical and Subtropical Grasslands, Savannas and Shrublands	East African Acacia Savannas	Photograph	no data	Andrew Stein
Non-melanistic 253	*pardus*	Tumaren Ranch, Kenya	0,1099	36,7982	Tropical and Subtropical Grasslands, Savannas and Shrublands	East African Acacia Savannas	Photograph	2009	Andrew Stein
Non-melanistic 254	*pardus*	Tumaren Ranch, Kenya	0,1601	36,6890	Tropical and Subtropical Grasslands, Savannas and Shrublands	East African Acacia Savannas	Photograph	2000	Andrew Stein
Non-melanistic 255	*pardus*	Tumaren Ranch, Kenya	0,1252	36,8827	Tropical and Subtropical Grasslands, Savannas and Shrublands	East African Acacia Savannas	Photograph	2010	Andrew Stein
Non-melanistic 256	*pardus*	Tumaren Ranch, Kenya	0,1113	36,8903	Tropical and Subtropical Grasslands, Savannas and Shrublands	East African Acacia Savannas	Photograph	2009	Andrew Stein
Non-melanistic 257	*pardus*	Tumaren Ranch, Kenya	-0,0001	36,8788	Tropical and Subtropical Grasslands, Savannas and Shrublands	East African Acacia Savannas	Photograph	2008	Andrew Stein
Non-melanistic 258	*pardus*	Voi, Coast Province, Kenya	-3,3767	38,5138	Tropical and Subtropical Grasslands, Savannas and Shrublands	East African Acacia Savannas	Photograph	1911	National Museum of Natural History USA
Non-melanistic 259	*delacouri*	Nam Et-Phou Louey, Laos	20,6599	103,2908	Tropical and Subtropical Moist Broadleaf Forests	North Indochina subtropical moist forests	Photograph	2009	Bruce Kekule
Non-melanistic 260	*delacouri*	Plateau Bolovens, Laos	15,3908	106,3461	Tropical and Subtropical Moist Broadleaf Forests	Annamite Range moist forests	Photograph	1932	American Museum of Natural History USA
Non-melanistic 261	*pardus*	Monrovia, Liberia	6,3345	-10,6443	Tropical and Subtropical Moist Broadleaf Forests	Guinean Moist Forests	Photograph	no data	American Museum of Natural History USA
Non-melanistic 262	*pardus*	Lifupa Game Camp, Malawi	-13,0872	33,1512	Tropical and Subtropical Grasslands, Savannas and Shrublands	Southern Miombo woodlands	Photograph	no data	Smithsonian Institution
Non-melanistic 263	*pardus*	Lifupa Game Camp, Malawi	-13,1053	33,1605	Tropical and Subtropical Grasslands, Savannas and Shrublands	Southern Miombo woodlands	Photograph	no data	Smithsonian Institution
Non-melanistic 264	*pardus*	Mbobo, Malawi	-13,0286	33,9612	Tropical and Subtropical Grasslands, Savannas and Shrublands	Central Zambezian Miombo woodlands	Photograph	1946	American Museum of Natural History USA
Non-melanistic 265	*delacouri*	Endau-Rompin National Park, Malaysia	6,3561	101,3821	Tropical and Subtropical Moist Broadleaf Forests	Peninsular Malaysian rain forests	Photograph	2003	Asian Leopard Project
Non-melanistic 266	*delacouri*	Endau-Rompin National Park, Malaysia	6,0600	101,5340	Tropical and Subtropical Moist Broadleaf Forests	Peninsular Malaysian rain forests	Photograph	2010	Bruce Kekule
Non-melanistic 267	*delacouri*	Salween River, Myanmar	20,0657	98,4779	Tropical and Subtropical Moist Broadleaf Forests	Kayah-Karen/Tenasserim moist forests	Photograph	1899	Bertha Ferrars
Non-melanistic 268	*pardus*	Chiputo, Mocambique	-14,8612	32,2915	Tropical and Subtropical Grasslands, Savannas and Shrublands	Southern Miombo woodlands	Photograph	no data	American Museum of Natural History USA
Non-melanistic 269	*pardus*	Lake Malawi, Mocambique	-12,5962	34,9996	Tropical and Subtropical Grasslands, Savannas and Shrublands	Eastern Miombo woodlands	Photograph	no data	National Museum of Natural History USA
Non-melanistic 270	*pardus*	Niassa, Mocambique	-12,1415	36,1377	Tropical and Subtropical Grasslands, Savannas and Shrublands	Eastern Miombo woodlands	Photograph	2013	Niassa Lion Project
Non-melanistic 271	*pardus*	Chasie, Karakuwisa, Namibia	-19,1400	20,1400	Tropical and Subtropical Grasslands, Savannas and Shrublands	Kalahari Acacia-Baikiaea woodlands	Photograph	1952	National Museum of Natural History USA
Non-melanistic 272	*pardus*	Chasie, Karakuwisa, Namibia	-19,1400	20,1400	Tropical and Subtropical Grasslands, Savannas and Shrublands	Kalahari Acacia-Baikiaea woodlands	Photograph	1952	National Museum of Natural History USA
Non-melanistic 273	*pardus*	Epukiro, Namibia	-21,6196	20,0000	Deserts and Xeric Shrublands	Kalahari xeric savanna	Photograph	2012	Andrew Stein
Non-melanistic 274	*pardus*	Erindi Game Reserve, Namibia	-21,4790	16,4574	Deserts and Xeric Shrublands	Kalahari xeric savanna	Photograph	no data	Andrew Stein
Non-melanistic 275	*pardus*	Erindi Game Reserve, Namibia	-21,6078	16,4067	Deserts and Xeric Shrublands	Kalahari xeric savanna	Photograph	2010	Andrew Stein
Non-melanistic 276	*pardus*	Ettien Reserve, Namibia	-20,7896	19,9967	Tropical and Subtropical Grasslands, Savannas and Shrublands	Kalahari Acacia-Baikiaea woodlands	Photograph	no data	Andrew Stein
Non-melanistic 277	*pardus*	Ku Game Ranch, Namibia	-19,9140	16,1918	Tropical and Subtropical Grasslands, Savannas and Shrublands	Angolan Mopane woodlands	Photograph	no data	Ezekiel Fabiano Chimbioputo
Non-melanistic 278	*pardus*	Naukluft Mountains Park, Namibia	-24,1521	16,2544	Deserts and Xeric Shrublands	Namibian savanna woodlands	Photograph	2013	Duke University
Non-melanistic 279	*pardus*	Naukluft Mountains Park, Namibia	-24,1954	16,1514	Deserts and Xeric Shrublands	Namibian savanna woodlands	Photograph	2013	Duke University
Non-melanistic 280	*pardus*	Okaputa, Namibia	-20,0934	17,5168	Tropical and Subtropical Grasslands, Savannas and Shrublands	Kalahari Acacia-Baikiaea woodlands	Photograph	no data	Andrew Stein
Non-melanistic 281	*pardus*	Okaputa, Namibia	-20,0934	17,5168	Tropical and Subtropical Grasslands, Savannas and Shrublands	Kalahari Acacia-Baikiaea woodlands	Photograph	no data	Andrew Stein
Non-melanistic 282	*pardus*	Okaputa, Namibia	-20,0934	17,5168	Tropical and Subtropical Grasslands, Savannas and Shrublands	Kalahari Acacia-Baikiaea woodlands	Photograph	no data	Andrew Stein
Non-melanistic 283	*pardus*	Okaputa, Namibia	-20,0934	17,5168	Tropical and Subtropical Grasslands, Savannas and Shrublands	Kalahari Acacia-Baikiaea woodlands	Photograph	no data	Andrew Stein
Non-melanistic 284	*pardus*	Otjinene, Namibia	-20,8011	20,1926	Tropical and Subtropical Grasslands, Savannas and Shrublands	Kalahari Acacia-Baikiaea woodlands	Photograph	2012	Andrew Stein
Non-melanistic 285	*pardus*	Otjiwarongo, Namibia	-20,5101	16,7498	Deserts and Xeric Shrublands	Kalahari xeric savanna	Photograph	2009	Ezekiel Fabiano Chimbioputo
Non-melanistic 286	*pardus*	Otjiwarongo, Namibia	-20,4627	17,1710	Deserts and Xeric Shrublands	Kalahari xeric savanna	Photograph	2010	Ezekiel Fabiano Chimbioputo
Non-melanistic 287	*pardus*	Otjiwarongo, Namibia	-20,4630	17,1714	Deserts and Xeric Shrublands	Kalahari xeric savanna	Photograph	2010	Ezekiel Fabiano Chimbioputo
Non-melanistic 288	*pardus*	Otjiwarongo, Namibia	-20,4364	17,1139	Deserts and Xeric Shrublands	Kalahari xeric savanna	Photograph	2010	Ezekiel Fabiano Chimbioputo
Non-melanistic 289	*pardus*	Otjiwarongo, Namibia	-20,3995	17,0962	Deserts and Xeric Shrublands	Kalahari xeric savanna	Photograph	2010	Ezekiel Fabiano Chimbioputo
Non-melanistic 290	*pardus*	Otjiwarongo, Namibia	-20,4582	17,0907	Deserts and Xeric Shrublands	Kalahari xeric savanna	Photograph	2010	Ezekiel Fabiano Chimbioputo
Non-melanistic 291	*pardus*	Otjiwarongo, Namibia	-20,3890	17,0827	Deserts and Xeric Shrublands	Kalahari xeric savanna	Photograph	2010	Ezekiel Fabiano Chimbioputo
Non-melanistic 292	*pardus*	Otjiwarongo, Namibia	-20,4587	17,1401	Deserts and Xeric Shrublands	Kalahari xeric savanna	Photograph	2010	Ezekiel Fabiano Chimbioputo
Non-melanistic 293	*pardus*	Otjiwarongo, Namibia	-20,4674	16,9741	Deserts and Xeric Shrublands	Kalahari xeric savanna	Photograph	2010	Ezekiel Fabiano Chimbioputo
Non-melanistic 294	*pardus*	Otjiwarongo, Namibia	-20,4788	17,1425	Deserts and Xeric Shrublands	Kalahari xeric savanna	Photograph	2011	Ezekiel Fabiano Chimbioputo
Non-melanistic 295	*pardus*	Otjiwarongo, Namibia	-20,4331	17,0815	Deserts and Xeric Shrublands	Kalahari xeric savanna	Photograph	2011	Ezekiel Fabiano Chimbioputo

Id	Subspecies	Location	Deg. - WGS84		Biome	Ecorregion	Sample	Year	Source
			Latitude	Longitude					
Non-melanistic 296	*pardus*	Reitfonten, Namibia	-20,8792	20,8462	Tropical and Subtropical Grasslands, Savannas and Shrublands	Kalahari Acacia-Baikiaea woodlands	Photograph	2011	Smithsonian Institution
Non-melanistic 297	*pardus*	Reitfonten, Namibia	-21,4373	20,6209	Tropical and Subtropical Grasslands, Savannas and Shrublands	Kalahari Acacia-Baikiaea woodlands	Photograph	2011	Smithsonian Institution
Non-melanistic 298	*pardus*	Tsumkwe, Namibia	-19,7844	20,5430	Tropical and Subtropical Grasslands, Savannas and Shrublands	Kalahari Acacia-Baikiaea woodlands	Photograph	2011	Smithsonian Institution
Non-melanistic 299	*pardus*	Waterberg, Namibia	-20,4613	17,2081	Deserts and Xeric Shrublands	Kalahari xeric savanna	Photograph	no data	Andrew Stein
Non-melanistic 300	*pardus*	Waterberg, Namibia	-20,4613	17,2081	Deserts and Xeric Shrublands	Kalahari xeric savanna	Photograph	no data	Andrew Stein
Non-melanistic 301	*pardus*	Waterberg, Namibia	-20,4613	17,2081	Deserts and Xeric Shrublands	Kalahari xeric savanna	Photograph	no data	Andrew Stein
Non-melanistic 302	*pardus*	Waterberg, Namibia	-20,4613	17,2081	Deserts and Xeric Shrublands	Kalahari xeric savanna	Photograph	no data	Andrew Stein
Non-melanistic 303	*pardus*	Waterberg, Namibia	-20,4613	17,2081	Deserts and Xeric Shrublands	Kalahari xeric savanna	Photograph	no data	Andrew Stein
Non-melanistic 304	*fucsia*	Bardia National Park, Nepal	28,7941	81,1997	Tropical and Subtropical Moist Broadleaf Forests	Himalayan subtropical broadleaf forests	Photograph	no data	Smithsonian Institution
Non-melanistic 305	*fucsia*	Chitwan National Park, Nepal	27,4529	84,4404	Tropical and Subtropical Moist Broadleaf Forests	Himalayan subtropical broadleaf forests	Photograph	no data	Michigan State University
Non-melanistic 306	*fucsia*	Chitwan National Park, Nepal	27,4979	84,0197	Tropical and Subtropical Moist Broadleaf Forests	Himalayan subtropical broadleaf forests	Photograph	2010	Michigan State University
Non-melanistic 307	*fusca*	Ghansa, Nepal	28,7834	83,7560	Temperate Broadleaf and Mixed Forests	Western Himalayan broadleaf forests	Photograph	no data	Ghimirey 2006
Non-melanistic 308	*pardus*	Donga, Nigeria	7,6133	10,0462	Tropical and Subtropical Grasslands, Savannas and Shrublands	Guinean forest-savanna mosaic	Photograph	no data	National Geographic Society
Non-melanistic 309	*pardus*	Niger Delta, Nigeria	5,1980	6,3856	Tropical and Subtropical Moist Broadleaf Forests	Niger Delta swamp forests	Photograph	no data	Ikemeh 2007
Non-melanistic 310	*pardus*	Otuan, Nigeria	4,8771	6,0880	Tropical and Subtropical Moist Broadleaf Forests	Niger Delta swamp forests	Photograph	1961	National Museum of Natural History USA
Non-melanistic 311	*nimr*	Dofar Mountains, Oman	17,2705	53,6453	Deserts and Xeric Shrublands	Red Sea Nubo-Sindian tropical desert and semi-desert	Photograph	no data	British Exploring Society
Non-melanistic 312	*nimr*	Jabal Samhan Nature Reserve, Oman	17,2712	54,8702	Deserts and Xeric Shrublands	Arabian Highlands woodlands and shrublands	Photograph	no data	Jane Budd
Non-melanistic 313	*nimr*	Jabal Samhan Nature Reserve, Oman	17,2246	55,1100	Deserts and Xeric Shrublands	Arabian Highlands woodlands and shrublands	Photograph	no data	Spalton et al 2006
Non-melanistic 314	*nimr*	Samhan Nature Reserve, Oman	17,0013	54,8161	Deserts and Xeric Shrublands	Arabian Highlands woodlands and shrublands	Photograph	no data	Jane Budd
Non-melanistic 315	*nimr*	Samhan Nature Reserve, Oman	17,0792	54,8472	Deserts and Xeric Shrublands	Arabian Highlands woodlands and shrublands	Photograph	no data	Jane Budd
Non-melanistic 316	*fusca*	Machiara National Park, Pakistan	35,6015	74,2158	Temperate Coniferous Forest	Western Himalayan temperate forests	Photograph	2012	World Wild Fund
Non-melanistic 317	*fusca*	Pir Lasora National Park, Pakistan	33,4133	74,0126	Tropical and Subtropical Coniferous Forests	Himalayan subtropical pine forests	Photograph	no data	World Wild Fund
Non-melanistic 318	*fusca*	Pir Lasora National Park, Pakistan	33,3329	74,0563	Tropical and Subtropical Coniferous Forests	Himalayan subtropical pine forests	Photograph	no data	World Wild Fund
Non-melanistic 319	*orientalis*	Ayandeki, Russia	43,4387	131,3109	Temperate Broadleaf and Mixed Forests	Manchurian mixed forests	Photograph	no data	World Wild Fund
Non-melanistic 320	*orientalis*	Kedrovaya Pad Reserve, Russia	43,8189	131,5116	Temperate Broadleaf and Mixed Forests	Manchurian mixed forests	Photograph	no data	Yury Shibnev
Non-melanistic 321	*orientalis*	Kedrovaya Pad Reserve, Russia	43,5906	131,5544	Temperate Broadleaf and Mixed Forests	Manchurian mixed forests	Photograph	no data	Yury Shibnev
Non-melanistic 322	*orientalis*	Primorskiy Krai, Nezhino Hunting Lease, Russia	43,7012	131,7596	Temperate Broadleaf and Mixed Forests	Manchurian mixed forests	Photograph	no data	Ekaterina Nicolaeva/Dale Miquelle
Non-melanistic 323	*orientalis*	Primorskiy Krai, Nezhino Hunting Lease, Russia	43,7012	131,7596	Temperate Broadleaf and Mixed Forests	Manchurian mixed forests	Photograph	no data	Ekaterina Nicolaeva/Dale Miquelle
Non-melanistic 324	*orientalis*	Primorskiy Krai, Nezhino Hunting Lease, Russia	43,7012	131,7596	Temperate Broadleaf and Mixed Forests	Manchurian mixed forests	Photograph	no data	Ekaterina Nicolaeva/Dale Miquelle
Non-melanistic 325	*orientalis*	Primorskiy Krai, Nezhino Hunting Lease, Russia	43,7012	131,7596	Temperate Broadleaf and Mixed Forests	Manchurian mixed forests	Photograph	no data	Ekaterina Nicolaeva/Dale Miquelle
Non-melanistic 326	*orientalis*	Primorskiy Krai, Nezhino Hunting Lease, Russia	43,3135	131,2976	Temperate Broadleaf and Mixed Forests	Manchurian mixed forests	Photograph	no data	Ekaterina Nicolaeva/Dale Miquelle
Non-melanistic 327	*orientalis*	Primorskiy Krai, Nezhino Hunting Lease, Russia	43,3135	131,2976	Temperate Broadleaf and Mixed Forests	Manchurian mixed forests	Photograph	no data	Ekaterina Nicolaeva/Dale Miquelle
Non-melanistic 328	*orientalis*	Primorskiy Krai, Nezhino Hunting Lease, Russia	43,3135	131,2976	Temperate Broadleaf and Mixed Forests	Manchurian mixed forests	Photograph	no data	Ekaterina Nicolaeva/Dale Miquelle
Non-melanistic 329	*orientalis*	Primorskiy Krai, Nezhino Hunting Lease, Russia	43,3135	131,2976	Temperate Broadleaf and Mixed Forests	Manchurian mixed forests	Photograph	no data	Ekaterina Nicolaeva/Dale Miquelle
Non-melanistic 330	*orientalis*	Primorskiy Krai, Nezhino Hunting Lease, Russia	43,3135	131,2976	Temperate Broadleaf and Mixed Forests	Manchurian mixed forests	Photograph	no data	Ekaterina Nicolaeva/Dale Miquelle
Non-melanistic 331	*orientalis*	Primorskiy Krai, Nezhino Hunting Lease, Russia	43,0242	131,1564	Temperate Broadleaf and Mixed Forests	Manchurian mixed forests	Photograph	no data	Ekaterina Nicolaeva/Dale Miquelle
Non-melanistic 332	*orientalis*	Primorskiy Krai, Nezhino Hunting Lease, Russia	43,0242	131,1564	Temperate Broadleaf and Mixed Forests	Manchurian mixed forests	Photograph	no data	Ekaterina Nicolaeva/Dale Miquelle
Non-melanistic 333	*orientalis*	Primorskiy Krai, Nezhino Hunting Lease, Russia	43,0242	131,1564	Temperate Broadleaf and Mixed Forests	Manchurian mixed forests	Photograph	no data	Ekaterina Nicolaeva/Dale Miquelle
Non-melanistic 334	*orientalis*	Primorskiy Krai, Nezhino Hunting Lease, Russia	43,0242	131,1564	Temperate Broadleaf and Mixed Forests	Manchurian mixed forests	Photograph	no data	Ekaterina Nicolaeva/Dale Miquelle
Non-melanistic 335	*orientalis*	Primorskiy Krai, Nezhino Hunting Lease, Russia	43,0242	131,1564	Temperate Broadleaf and Mixed Forests	Manchurian mixed forests	Photograph	no data	Ekaterina Nicolaeva/Dale Miquelle
Non-melanistic 336	*orientalis*	Primorskiy Krai, Nezhino Hunting Lease, Russia	42,8721	131,1602	Temperate Broadleaf and Mixed Forests	Manchurian mixed forests	Photograph	no data	Ekaterina Nicolaeva/Dale Miquelle
Non-melanistic 337	*orientalis*	Primorskiy Krai, Nezhino Hunting Lease, Russia	42,8721	131,1602	Temperate Broadleaf and Mixed Forests	Manchurian mixed forests	Photograph	no data	Ekaterina Nicolaeva/Dale Miquelle
Non-melanistic 338	*orientalis*	Primorskiy Krai, Nezhino Hunting Lease, Russia	42,8721	131,1602	Temperate Broadleaf and Mixed Forests	Manchurian mixed forests	Photograph	no data	Ekaterina Nicolaeva/Dale Miquelle
Non-melanistic 339	*orientalis*	Primorskiy Krai, Nezhino Hunting Lease, Russia	42,8721	131,1602	Temperate Broadleaf and Mixed Forests	Manchurian mixed forests	Photograph	no data	Ekaterina Nicolaeva/Dale Miquelle
Non-melanistic 340	*orientalis*	Primorskiy Krai, Nezhino Hunting Lease, Russia	42,8721	131,1602	Temperate Broadleaf and Mixed Forests	Manchurian mixed forests	Photograph	no data	Ekaterina Nicolaeva/Dale Miquelle
Non-melanistic 341	*orientalis*	Primorskiy Krai, Nezhino Hunting Lease, Russia	42,8721	131,1602	Temperate Broadleaf and Mixed Forests	Manchurian mixed forests	Photograph	no data	Ekaterina Nicolaeva/Dale Miquelle
Non-melanistic 342	*orientalis*	Primorskiy Krai, Nezhino Hunting Lease, Russia	42,8721	131,1602	Temperate Broadleaf and Mixed Forests	Manchurian mixed forests	Photograph	no data	Ekaterina Nicolaeva/Dale Miquelle
Non-melanistic 343	*orientalis*	Primorskiy Krai, Nezhino Hunting Lease, Russia	42,8094	130,7478	Temperate Broadleaf and Mixed Forests	Manchurian mixed forests	Photograph	no data	Ekaterina Nicolaeva/Dale Miquelle
Non-melanistic 344	*orientalis*	Primorskiy Krai, Nezhino Hunting Lease, Russia	42,8094	130,7478	Temperate Broadleaf and Mixed Forests	Manchurian mixed forests	Photograph	no data	Ekaterina Nicolaeva/Dale Miquelle
Non-melanistic 345	*orientalis*	Primorskiy Krai, Nezhino Hunting Lease, Russia	42,8094	130,7478	Temperate Broadleaf and Mixed Forests	Manchurian mixed forests	Photograph	no data	Ekaterina Nicolaeva/Dale Miquelle
Non-melanistic 346	*orientalis*	Primorskiy Krai, Nezhino Hunting Lease, Russia	42,8094	130,7478	Temperate Broadleaf and Mixed Forests	Manchurian mixed forests	Photograph	no data	Ekaterina Nicolaeva/Dale Miquelle
Non-melanistic 347	*orientalis*	Southwest Primorye, Russia	43,5209	131,7363	Temperate Broadleaf and Mixed Forests	Manchurian mixed forests	Photograph	2004	Wildlife Conservation Society - Alexander Reebin
Non-melanistic 348	*orientalis*	Southwest Primorye, Russia	43,4308	131,5017	Temperate Broadleaf and Mixed Forests	Manchurian mixed forests	Photograph	2007	Wildlife Conservation Society - Alexander Reebin
Non-melanistic 349	*orientalis*	Southwest Primorye, Russia	43,4968	131,6842	Temperate Broadleaf and Mixed Forests	Manchurian mixed forests	Photograph	2003	Wildlife Conservation Society - Alexander Reebin
Non-melanistic 350	*orientalis*	Southwest Primorye, Russia	43,4772	131,6761	Temperate Broadleaf and Mixed Forests	Manchurian mixed forests	Photograph	no data	Wildlife Conservation Society - Alexander Reebin
Non-melanistic 351	*orientalis*	Southwest Primorye, Russia	43,4405	131,4546	Temperate Broadleaf and Mixed Forests	Manchurian mixed forests	Photograph	2004	Wildlife Conservation Society - Alexander Reebin
Non-melanistic 352	*orientalis*	Southwest Primorye, Russia	43,3997	131,6481	Temperate Broadleaf and Mixed Forests	Manchurian mixed forests	Photograph	2004	Wildlife Conservation Society - Alexander Reebin
Non-melanistic 353	*orientalis*	Southwest Primorye, Russia	43,3997	131,6481	Temperate Broadleaf and Mixed Forests	Manchurian mixed forests	Photograph	2004	Wildlife Conservation Society - Alexander Reebin
Non-melanistic 354	*orientalis*	Southwest Primorye, Russia	43,3997	131,6481	Temperate Broadleaf and Mixed Forests	Manchurian mixed forests	Photograph	2004	Wildlife Conservation Society - Alexander Reebin
Non-melanistic 355	*orientalis*	Southwest Primorye, Russia	43,3997	131,6481	Temperate Broadleaf and Mixed Forests	Manchurian mixed forests	Photograph	2004	Wildlife Conservation Society - Alexander Reebin

Id	Subspecies	Location	Deg. - WGS84		Biome	Ecorregion	Sample	Year	Source
			Latitude	Longitude					
Non-melanistic 356	*orientalis*	Southwest Primorye, Russia	43,5018	131,5278	Temperate Broadleaf and Mixed Forests	Manchurian mixed forests	Photograph	2004	Wildlife Conservation Society - Alexander Reebin
Non-melanistic 357	*orientalis*	Southwest Primorye, Russia	43,4375	131,7086	Temperate Broadleaf and Mixed Forests	Manchurian mixed forests	Photograph	2001	Wildlife Conservation Society - Alexander Reebin
Non-melanistic 358	*orientalis*	Southwest Primorye, Russia	43,4375	131,7086	Temperate Broadleaf and Mixed Forests	Manchurian mixed forests	Photograph	2004	Wildlife Conservation Society - Alexander Reebin
Non-melanistic 359	*orientalis*	Southwest Primorye, Russia	43,4765	131,6034	Temperate Broadleaf and Mixed Forests	Manchurian mixed forests	Photograph	2004	Wildlife Conservation Society - Alexander Reebin
Non-melanistic 360	*orientalis*	Southwest Primorye, Russia	43,4765	131,6034	Temperate Broadleaf and Mixed Forests	Manchurian mixed forests	Photograph	2007	Wildlife Conservation Society - Alexander Reebin
Non-melanistic 361	*orientalis*	Southwest Primorye, Russia	43,5164	131,6544	Temperate Broadleaf and Mixed Forests	Manchurian mixed forests	Photograph	2005	Wildlife Conservation Society - Alexander Reebin
Non-melanistic 362	*orientalis*	Southwest Primorye, Russia	43,4693	131,5529	Temperate Broadleaf and Mixed Forests	Manchurian mixed forests	Photograph	2005	Wildlife Conservation Society - Alexander Reebin
Non-melanistic 363	*orientalis*	Southwest Primorye, Russia	43,4821	131,5401	Temperate Broadleaf and Mixed Forests	Manchurian mixed forests	Photograph	2005	Wildlife Conservation Society - Alexander Reebin
Non-melanistic 364	*orientalis*	Southwest Primorye, Russia	43,4511	131,5435	Temperate Broadleaf and Mixed Forests	Manchurian mixed forests	Photograph	2011	Wildlife Conservation Society - Alexander Reebin
Non-melanistic 365	*orientalis*	Southwest Primorye, Russia	43,4189	131,5842	Temperate Broadleaf and Mixed Forests	Manchurian mixed forests	Photograph	2007	Wildlife Conservation Society - Alexander Reebin
Non-melanistic 366	*orientalis*	Southwest Primorye, Russia	43,4096	131,4165	Temperate Broadleaf and Mixed Forests	Manchurian mixed forests	Photograph	2011	Wildlife Conservation Society - Alexander Reebin
Non-melanistic 367	*orientalis*	Southwest Primorye, Russia	43,4096	131,4165	Temperate Broadleaf and Mixed Forests	Manchurian mixed forests	Photograph	2007	Wildlife Conservation Society - Alexander Reebin
Non-melanistic 368	*orientalis*	Southwest Primorye, Russia	43,4096	131,4165	Temperate Broadleaf and Mixed Forests	Manchurian mixed forests	Photograph	2011	Wildlife Conservation Society - Alexander Reebin
Non-melanistic 369	*orientalis*	Southwest Primorye, Russia	43,3791	131,5503	Temperate Broadleaf and Mixed Forests	Manchurian mixed forests	Photograph	2007	Wildlife Conservation Society - Alexander Reebin
Non-melanistic 370	*orientalis*	Southwest Primorye, Russia	43,5060	131,6388	Temperate Broadleaf and Mixed Forests	Manchurian mixed forests	Photograph	2007	Wildlife Conservation Society - Alexander Reebin
Non-melanistic 371	*orientalis*	Southwest Primorye, Russia	43,5333	131,7144	Temperate Broadleaf and Mixed Forests	Manchurian mixed forests	Photograph	2007	Wildlife Conservation Society - Alexander Reebin
Non-melanistic 372	*orientalis*	Southwest Primorye, Russia	43,5333	131,7144	Temperate Broadleaf and Mixed Forests	Manchurian mixed forests	Photograph	2007	Wildlife Conservation Society - Alexander Reebin
Non-melanistic 373	*orientalis*	Southwest Primorye, Russia	43,5333	131,7144	Temperate Broadleaf and Mixed Forests	Manchurian mixed forests	Photograph	2008	Wildlife Conservation Society - Alexander Reebin
Non-melanistic 374	*orientalis*	Southwest Primorye, Russia	43,5333	131,7144	Temperate Broadleaf and Mixed Forests	Manchurian mixed forests	Photograph	2008	Wildlife Conservation Society - Alexander Reebin
Non-melanistic 375	*orientalis*	Southwest Primorye, Russia	43,3238	131,5431	Temperate Broadleaf and Mixed Forests	Manchurian mixed forests	Photograph	2008	Wildlife Conservation Society - Alexander Reebin
Non-melanistic 376	*orientalis*	Southwest Primorye, Russia	43,3506	131,4963	Temperate Broadleaf and Mixed Forests	Manchurian mixed forests	Photograph	2009	Wildlife Conservation Society - Alexander Reebin
Non-melanistic 377	*orientalis*	Southwest Primorye, Russia	43,3506	131,4963	Temperate Broadleaf and Mixed Forests	Manchurian mixed forests	Photograph	2011	Wildlife Conservation Society - Alexander Reebin
Non-melanistic 378	*orientalis*	Southwest Primorye, Russia	43,3506	131,4963	Temperate Broadleaf and Mixed Forests	Manchurian mixed forests	Photograph	2010	Wildlife Conservation Society - Alexander Reebin
Non-melanistic 379	*orientalis*	Southwest Primorye, Russia	43,3506	131,4963	Temperate Broadleaf and Mixed Forests	Manchurian mixed forests	Photograph	2010	Wildlife Conservation Society - Alexander Reebin
Non-melanistic 380	*orientalis*	Southwest Primorye, Russia	43,3506	131,4963	Temperate Broadleaf and Mixed Forests	Manchurian mixed forests	Photograph	2010	Wildlife Conservation Society - Alexander Reebin
Non-melanistic 381	*orientalis*	Southwest Primorye, Russia	43,3506	131,4963	Temperate Broadleaf and Mixed Forests	Manchurian mixed forests	Photograph	2011	Wildlife Conservation Society - Alexander Reebin
Non-melanistic 382	*orientalis*	Southwest Primorye, Russia	43,3506	131,4963	Temperate Broadleaf and Mixed Forests	Manchurian mixed forests	Photograph	2010	Wildlife Conservation Society - Alexander Reebin
Non-melanistic 383	*orientalis*	Southwest Primorye, Russia	43,3506	131,4963	Temperate Broadleaf and Mixed Forests	Manchurian mixed forests	Photograph	2011	Wildlife Conservation Society - Alexander Reebin
Non-melanistic 384	*orientalis*	Southwest Primorye, Russia	43,3506	131,4963	Temperate Broadleaf and Mixed Forests	Manchurian mixed forests	Photograph	2011	Wildlife Conservation Society - Alexander Reebin
Non-melanistic 385	*orientalis*	Southwest Primorye, Russia	43,3506	131,4963	Temperate Broadleaf and Mixed Forests	Manchurian mixed forests	Photograph	2011	Wildlife Conservation Society - Alexander Reebin
Non-melanistic 386	*orientalis*	Southwest Primorye, Russia	43,4439	131,5999	Temperate Broadleaf and Mixed Forests	Manchurian mixed forests	Photograph	2011	Wildlife Conservation Society - Alexander Reebin
Non-melanistic 387	*orientalis*	Southwest Primorye, Russia	43,4439	131,5999	Temperate Broadleaf and Mixed Forests	Manchurian mixed forests	Photograph	2011	Wildlife Conservation Society - Alexander Reebin
Non-melanistic 388	*orientalis*	Ussuri, Nicolsk, Russia	43,8230	132,0324	Tundra	Suiphun-Khanka meadows and forest meadows	Photograph	1930	American Museum of Natural History USA
Non-melanistic 389	*orientalis*	Ussuri, Okransk, Russia	43,8283	131,8699	Tundra	Suiphun-Khanka meadows and forest meadows	Photograph	1930	American Museum of Natural History USA
Non-melanistic 390	*pardus*	Kigali, Rwanda	-1,9764	30,0001	Tropical and Subtropical Grasslands, Savannas and Shrublands	Victoria Basin forest-savanna mosaic	Photograph	no data	Smithsonian Institution
Non-melanistic 391	*pardus*	Agulhas Plain Great Hermanus Area, South Africa	-34,6572	19,7481	Mediterranean Forests, Woodlands, and Scrub	Lowland fynbos and renosterveld	Photograph	2012	Landmark Foundation
Non-melanistic 392	*pardus*	Agulhas Plain Great Hermanus Area, South Africa	-34,6418	19,7119	Mediterranean Forests, Woodlands, and Scrub	Lowland fynbos and renosterveld	Photograph	2012	Landmark Foundation
Non-melanistic 393	*pardus*	Cederberg Mountains, Western Cape, South Africa	-32,2916	19,4120	Deserts and Xeric Shrublands	Namib-Karoo-Kaokoveld Deserts and Shrublands	Photograph	2010	Guy Balme
Non-melanistic 394	*pardus*	Cederberg Mountains, Western Cape, South Africa	-32,3383	19,1853	Mediterranean Forests, Woodlands, and Scrub	Montane fynbos and renosterveld	Photograph	no data	Guy Balme
Non-melanistic 395	*pardus*	Franschhoek La Motte Hiking Trail, South Africa	-33,9428	19,1925	Mediterranean Forests, Woodlands, and Scrub	Montane fynbos and renosterveld	Photograph	2011	Cape Leopard Trust
Non-melanistic 396	*pardus*	Franschhoek La Motte Hiking Trail, South Africa	-33,9687	19,2022	Mediterranean Forests, Woodlands, and Scrub	Montane fynbos and renosterveld	Photograph	2011	Cape Leopard Trust
Non-melanistic 397	*pardus*	Hoedspruit Game Reserve, South Africa	-24,1221	31,1049	Tropical and Subtropical Grasslands, Savannas and Shrublands	Zambezian and Mopane woodlands	Photograph	no data	Guy Balme
Non-melanistic 398	*pardus*	Karatara, South Africa	-33,9502	22,3380	Mediterranean Forests, Woodlands, and Scrub	Fynbos	Photograph	2013	Braczkowski & Watson 2013
Non-melanistic 399	*pardus*	Karatara, South Africa	-33,8570	22,2120	Mediterranean Forests, Woodlands, and Scrub	Fynbos	Photograph	2013	Braczkowski & Watson 2013
Non-melanistic 400	*pardus*	Karongwe Reserve, South Africa	-24,5092	30,5079	Montane Grasslands and Shrublands	Drakensberg Montane Woodlands and Grasslands	Photograph	no data	Andrew Stein
Non-melanistic 401	*pardus*	Kruger National Park, South Africa	-24,5210	31,2337	Tropical and Subtropical Grasslands, Savannas and Shrublands	Zambezian and Mopane woodlands	Photograph	2013	Eduardo Eizirik
Non-melanistic 402	*pardus*	Kruger National Park, South Africa	-23,6331	30,6962	Tropical and Subtropical Grasslands, Savannas and Shrublands	Zambezian and Mopane woodlands	Photograph	2012	Daniel Rocha
Non-melanistic 403	*pardus*	Kruger National Park, South Africa	-22,8847	31,3549	Tropical and Subtropical Grasslands, Savannas and Shrublands	Zambezian and Mopane woodlands	Photograph	no data	Guy Balme
Non-melanistic 404	*pardus*	Kudu Game Ranch, South Africa	-24,7933	30,5083	Montane Grasslands and Shrublands	Drakensberg Montane Woodlands and Grasslands	Photograph	no data	Conservation International
Non-melanistic 405	*pardus*	KwaZulu-Natal, South Africa	-28,4606	30,6808	Montane Grasslands and Shrublands	Drakensberg Montane Woodlands and Grasslands	Photograph	no data	Andrew Stein
Non-melanistic 406	*pardus*	KwaZulu-Natal, South Africa	-28,4766	30,7523	Montane Grasslands and Shrublands	Drakensberg Montane Woodlands and Grasslands	Photograph	no data	Andrew Stein
Non-melanistic 407	*pardus*	Leap Vineyards, South Africa	-33,9187	19,6263	Deserts and Xeric Shrublands	Namib-Karoo-Kaokoveld Deserts and Shrublands	Photograph	2013	Cape Leopard Trust
Non-melanistic 408	*pardus*	Leap Vineyards, South Africa	-33,9525	19,6478	Deserts and Xeric Shrublands	Namib-Karoo-Kaokoveld Deserts and Shrublands	Photograph	2010	Cape Leopard Trust
Non-melanistic 409	*pardus*	Letaba, South Africa	-23,6260	31,5994	Tropical and Subtropical Grasslands, Savannas and Shrublands	Zambezian and Mopane woodlands	Photograph	2010	Michelle Altenkirk
Non-melanistic 410	*pardus*	Limpopo, South Africa	-22,5536	30,9343	Tropical and Subtropical Grasslands, Savannas and Shrublands	Southern Africa bushveld	Photograph	2004	Conservation International
Non-melanistic 411	*pardus*	Limpopo Waterberg Area, South Africa	-22,1575	29,6163	Tropical and Subtropical Grasslands, Savannas and Shrublands	Zambezian and Mopane woodlands	Photograph	no data	Andrew Stein
Non-melanistic 412	*pardus*	Loskop Dam Protected Area, South Africa	-25,4369	29,2630	Tropical and Subtropical Grasslands, Savannas and Shrublands	Southern Africa bushveld	Photograph	2004	Guy Balme
Non-melanistic 413	*pardus*	Lydenburg, South Africa	-24,8234	30,8106	Montane Grasslands and Shrublands	Drakensberg Montane Woodlands and Grasslands	Photograph	no data	Guy Balme
Non-melanistic 414	*pardus*	Lydenburg, South Africa	-24,6917	30,7609	Montane Grasslands and Shrublands	Drakensberg Montane Woodlands and Grasslands	Photograph	2011	Guy Balme
Non-melanistic 415	*pardus*	Lydenburg, South Africa	-24,8012	30,7291	Montane Grasslands and Shrublands	Drakensberg Montane Woodlands and Grasslands	Photograph	2010	Andrew Stein
Non-melanistic 416	*pardus*	Lydenburg, South Africa	-24,8079	30,6673	Montane Grasslands and Shrublands	Drakensberg Montane Woodlands and Grasslands	Photograph	2010	Andrew Stein

Id	Subspecies	Location	Deg. - WGS84		Biome	Ecorregion	Sample	Year	Source
			Latitude	Longitude					
Non-melanistic 417	*pardus*	Lydenburg, South Africa	-24,6807	30,8312	Montane Grasslands and Shrublands	Drakensberg Montane Woodlands and Grasslands	Photograph	2011	Andrew Stein
Non-melanistic 418	*pardus*	Lydenburg Leopard Camp, South Africa	-24,9668	30,3398	Montane Grasslands and Shrublands	Drakensberg Montane Woodlands and Grasslands	Photograph	2011	Daniel Rocha
Non-melanistic 419	*pardus*	Lydenburg Leopard Camp, South Africa	-25,0000	30,7428	Montane Grasslands and Shrublands	Drakensberg Montane Woodlands and Grasslands	Photograph	no data	Andrew Stein
Non-melanistic 420	*pardus*	Mkhuze Game Reserve, South Africa	-27,8100	32,0030	Montane Grasslands and Shrublands	Drakensberg Montane Woodlands and Grasslands	Photograph	no data	Guy Balme
Non-melanistic 421	*pardus*	Mkhuze Game Reserve, South Africa	-27,7886	31,8152	Montane Grasslands and Shrublands	Drakensberg Montane Woodlands and Grasslands	Photograph	2008	Smithsonian Institution
Non-melanistic 422	*pardus*	Mpumalanga, South Africa	-25,7211	31,6606	Tropical and Subtropical Grasslands, Savannas and Shrublands	Zambezian and Mopane woodlands	Photograph	2011	Michelle Altenkirk
Non-melanistic 423	*pardus*	Munyawana Leopard Project, South Africa	-27,7829	32,0600	Montane Grasslands and Shrublands	Drakensberg Montane Woodlands and Grasslands	Photograph	no data	Guy Balme
Non-melanistic 424	*pardus*	Phinda Private Game Reserve, South Africa	-27,8846	31,9637	Montane Grasslands and Shrublands	Drakensberg Montane Woodlands and Grasslands	Photograph	no data	Panthera
Non-melanistic 425	*pardus*	Riversdale, Western Cape, South Africa	-34,2139	21,1682	Mediterranean Forests, Woodlands, and Scrub	Fynbos	Photograph	2011	Landmark Foundation
Non-melanistic 426	*pardus*	Skukuza Road, South Africa	-24,9919	31,6263	Tropical and Subtropical Grasslands, Savannas and Shrublands	Zambezian and Mopane woodlands	Photograph	no data	Guy Balme
Non-melanistic 427	*pardus*	Somkhanda Game Reserve, South Africa	-27,7108	31,9462	Montane Grasslands and Shrublands	Drakensberg Montane Woodlands and Grasslands	Photograph	no data	Panthera
Non-melanistic 428	*pardus*	Somkhanda Game Reserve, South Africa	-27,7063	31,9791	Montane Grasslands and Shrublands	Drakensberg Montane Woodlands and Grasslands	Photograph	no data	Panthera
Non-melanistic 429	*pardus*	Somkhanda Game Reserve, South Africa	-27,7361	31,9650	Montane Grasslands and Shrublands	Drakensberg Montane Woodlands and Grasslands	Photograph	no data	Panthera
Non-melanistic 430	*pardus*	Somkhanda Game Reserve, South Africa	-27,8122	31,9274	Montane Grasslands and Shrublands	Drakensberg Montane Woodlands and Grasslands	Photograph	no data	Panthera
Non-melanistic 431	*pardus*	Steenkampsberg Mountains, Lydenburg, South Africa	-25,2164	30,5472	Montane Grasslands and Shrublands	Drakensberg Montane Woodlands and Grasslands	Photograph	2010	Panthera
Non-melanistic 432	*pardus*	Swartberg Area, South Africa	-30,1610	29,2539	Montane Grasslands and Shrublands	Drakensberg Montane Woodlands and Grasslands	Photograph	no data	Wildlife Conservation Society
Non-melanistic 433	*pardus*	Thaba Tholo Wilderness Reserve, South Africa	-24,9169	30,4675	Montane Grasslands and Shrublands	Drakensberg Montane Woodlands and Grasslands	Photograph	no data	TTWR
Non-melanistic 434	*pardus*	Thaba Tholo Wilderness Reserve, South Africa	-24,8565	30,5184	Montane Grasslands and Shrublands	Drakensberg Montane Woodlands and Grasslands	Photograph	2012	TTWR
Non-melanistic 435	*pardus*	Thaba Tholo Wilderness Reserve, South Africa	-24,8855	30,5195	Montane Grasslands and Shrublands	Drakensberg Montane Woodlands and Grasslands	Photograph	2012	TTWR
Non-melanistic 436	*pardus*	Thaba Tholo Wilderness Reserve, South Africa	-24,8700	30,4386	Montane Grasslands and Shrublands	Drakensberg Montane Woodlands and Grasslands	Photograph	no data	TTWR
Non-melanistic 437	*pardus*	Thaba Tholo Wilderness Reserve, South Africa	-24,6122	30,4586	Montane Grasslands and Shrublands	Drakensberg Montane Woodlands and Grasslands	Photograph	2011	TTWR
Non-melanistic 438	*pardus*	Thaba Tholo Wilderness Reserve, South Africa	-24,6237	30,3404	Tropical and Subtropical Grasslands, Savannas and Shrublands	Southern Africa bushveld	Photograph	2012	TTWR
Non-melanistic 439	*pardus*	Thaba Game Reserve, South Africa	-28,4257	30,6239	Montane Grasslands and Shrublands	Drakensberg Montane Woodlands and Grasslands	Photograph	no data	Panthera
Non-melanistic 440	*pardus*	Wemmershoek, South Africa	-33,7523	19,2081	Mediterranean Forests, Woodlands, and Scrub	Fynbos	Photograph	2011	Cape Leopard Trust
Non-melanistic 441	*pardus*	Wemmershoek, South Africa	-33,7523	19,2081	Mediterranean Forests, Woodlands, and Scrub	Fynbos	Photograph	2010	Cape Leopard Trust
Non-melanistic 442	*pardus*	Wemmershoek, South Africa	-33,7537	19,2903	Mediterranean Forests, Woodlands, and Scrub	Fynbos	Photograph	2011	Cape Leopard Trust
Non-melanistic 443	*pardus*	Wemmershoek, South Africa	-33,7895	19,2485	Mediterranean Forests, Woodlands, and Scrub	Fynbos	Photograph	2011	Cape Leopard Trust
Non-melanistic 444	*pardus*	Wemmershoek Mountains, South Africa	-33,7281	19,3583	Mediterranean Forests, Woodlands, and Scrub	Fynbos	Photograph	2010	Cape Leopard Trust
Non-melanistic 445	*kotiya*	Agrapatana, Sri Lanka	6,8015	80,6216	Tropical and Subtropical Moist Broadleaf Forests	Sri Lankan moist forest	Photograph	no data	Andrew Kittle
Non-melanistic 446	*kotiya*	Colombo, Western Province, Sri Lanka	6,9373	79,8917	Tropical and Subtropical Moist Broadleaf Forests	Sri Lankan moist forest	Photograph	1908	National Museum of Natural History USA
Non-melanistic 447	*kotiya*	Vavuniya Forest, Sri Lanka	8,8836	80,3568	Tropical and Subtropical Dry Broadleaf Forests	Sri Lanka dry-zone dry evergreen forests	Photograph	2004	Watson & Kittle 2004
Non-melanistic 448	*kotiya*	Dunumadalawa Forest, Sri Lanka	7,2034	80,6151	Tropical and Subtropical Moist Broadleaf Forests	Sri Lankan moist forest	Photograph	no data	Andrew Kittle
Non-melanistic 449	*kotiya*	Hantane, Kandy District, Sri Lanka	7,2709	80,6422	Tropical and Subtropical Moist Broadleaf Forests	Sri Lankan moist forest	Photograph	no data	Andrew Kittle
Non-melanistic 450	*kotiya*	Hantane, Kandy District, Sri Lanka	7,2553	80,6325	Tropical and Subtropical Moist Broadleaf Forests	Sri Lankan moist forest	Photograph	no data	Andrew Kittle
Non-melanistic 451	*kotiya*	Kantalai, Sri Lanka	8,3076	80,8441	Tropical and Subtropical Dry Broadleaf Forests	Sri Lanka dry-zone dry evergreen forests	Photograph	no data	Watson & Kittle 2004
Non-melanistic 452	*kotiya*	Nuwara Eliya, Sri Lanka	7,0260	80,7864	Tropical and Subtropical Moist Broadleaf Forests	Sri Lankan moist forest	Photograph	2013	Smithsonian Institution
Non-melanistic 453	*kotiya*	Wasgamuwa National Park, Sri Lanka	7,6389	80,9393	Tropical and Subtropical Dry Broadleaf Forests	Sri Lanka dry-zone dry evergreen forests	Photograph	no data	Andrew Kittle
Non-melanistic 454	*kotiya*	Yala National Park, Sri Lanka	6,4632	81,3839	Tropical and Subtropical Dry Broadleaf Forests	Sri Lanka dry-zone dry evergreen forests	Photograph	no data	Andrew Kittle
Non-melanistic 455	*kotiya*	Yala National Park, Sri Lanka	6,4632	81,3839	Tropical and Subtropical Dry Broadleaf Forests	Sri Lanka dry-zone dry evergreen forests	Photograph	no data	Andrew Kittle
Non-melanistic 456	*kotiya*	Yala National Park, Sri Lanka	6,4644	81,3266	Tropical and Subtropical Dry Broadleaf Forests	Sri Lanka dry-zone dry evergreen forests	Photograph	no data	Andrew Kittle
Non-melanistic 457	*kotiya*	Yala National Park, Sri Lanka	6,5198	81,4115	Tropical and Subtropical Dry Broadleaf Forests	Sri Lanka dry-zone dry evergreen forests	Photograph	no data	Andrew Kittle
Non-melanistic 458	*kotiya*	Yala National Park, Sri Lanka	6,5303	81,4220	Tropical and Subtropical Dry Broadleaf Forests	Sri Lanka dry-zone dry evergreen forests	Photograph	no data	Andrew Kittle
Non-melanistic 459	*kotiya*	Yala National Park, Sri Lanka	6,5079	81,4753	Tropical and Subtropical Dry Broadleaf Forests	Sri Lanka dry-zone dry evergreen forests	Photograph	no data	Andrew Kittle
Non-melanistic 460	*kotiya*	Yala National Park, Sri Lanka	6,4714	81,4582	Tropical and Subtropical Dry Broadleaf Forests	Sri Lanka dry-zone dry evergreen forests	Photograph	no data	Andrew Kittle
Non-melanistic 461	*kotiya*	Yala National Park, Sri Lanka	6,4813	81,5338	Tropical and Subtropical Dry Broadleaf Forests	Sri Lanka dry-zone dry evergreen forests	Photograph	no data	Andrew Kittle
Non-melanistic 462	*kotiya*	Yala National Park, Sri Lanka	6,4686	81,5292	Tropical and Subtropical Dry Broadleaf Forests	Sri Lanka dry-zone dry evergreen forests	Photograph	no data	Andrew Kittle
Non-melanistic 463	*kotiya*	Yala National Park, Sri Lanka	6,4785	81,5206	Tropical and Subtropical Dry Broadleaf Forests	Sri Lanka dry-zone dry evergreen forests	Photograph	no data	Andrew Kittle
Non-melanistic 464	*kotiya*	Yala National Park, Sri Lanka	6,4112	81,4706	Tropical and Subtropical Dry Broadleaf Forests	Sri Lanka dry-zone dry evergreen forests	Photograph	no data	Andrew Kittle
Non-melanistic 465	*kotiya*	Yala National Park, Sri Lanka	6,4077	81,4818	Tropical and Subtropical Dry Broadleaf Forests	Sri Lanka dry-zone dry evergreen forests	Photograph	no data	Andrew Kittle
Non-melanistic 466	*kotiya*	Yala National Park, Sri Lanka	6,4231	81,4825	Tropical and Subtropical Dry Broadleaf Forests	Sri Lanka dry-zone dry evergreen forests	Photograph	no data	Andrew Kittle
Non-melanistic 467	*kotiya*	Yala National Park, Sri Lanka	6,4239	81,4812	Tropical and Subtropical Dry Broadleaf Forests	Sri Lanka dry-zone dry evergreen forests	Photograph	no data	Andrew Kittle
Non-melanistic 468	*kotiya*	Yala National Park, Sri Lanka	6,4364	81,5556	Tropical and Subtropical Dry Broadleaf Forests	Sri Lanka dry-zone dry evergreen forests	Photograph	no data	Andrew Kittle
Non-melanistic 469	*kotiya*	Yala National Park, Sri Lanka	6,4077	81,5530	Tropical and Subtropical Dry Broadleaf Forests	Sri Lanka dry-zone dry evergreen forests	Photograph	no data	Andrew Kittle
Non-melanistic 470	*pardus*	El Dueim, Ash Shamaliyah, Sudan	14,0298	32,2618	Tropical and Subtropical Grasslands, Savannas and Shrublands	Sahelian Acacia savanna	Photograph	1910	National Museum of Natural History USA
Non-melanistic 471	*pardus*	Nimule National Park, Sudan	3,6133	32,1361	Tropical and Subtropical Grasslands, Savannas and Shrublands	East Sudanian savanna	Photograph	1962	American Museum of Natural History USA
Non-melanistic 472	*pardus*	Serengeti Plains, Tanzania	-2,1623	34,4294	Tropical and Subtropical Grasslands, Savannas and Shrublands	East African Acacia Savannas	Photograph	no data	American Museum of Natural History USA
Non-melanistic 473	*pardus*	Tanganyika, Rungwe, Tanzania	-5,4804	29,9287	Tropical and Subtropical Grasslands, Savannas and Shrublands	Central Zambezian Miombo woodlands	Photograph	1929	American Museum of Natural History USA
Non-melanistic 474	*pardus*	Tanganyika, Rungwe, Tanzania	-5,7615	30,3734	Tropical and Subtropical Grasslands, Savannas and Shrublands	Central Zambezian Miombo woodlands	Photograph	1929	American Museum of Natural History USA
Non-melanistic 475	*pardus*	Tanganyika, Rungwe, Tanzania	-6,1077	30,4335	Tropical and Subtropical Grasslands, Savannas and Shrublands	Central Zambezian Miombo woodlands	Photograph	1929	American Museum of Natural History USA
Non-melanistic 476	*pardus*	Serengeti National Park, Tanzania	-2,5763	34,3123	Tropical and Subtropical Grasslands, Savannas and Shrublands	East African Acacia Savannas	Photograph	no data	Andrew Stein
Non-melanistic 477	*pardus*	Serengeti National Park, Tanzania	-2,4335	34,5247	Tropical and Subtropical Grasslands, Savannas and Shrublands	East African Acacia Savannas	Photograph	no data	Andrew Stein

Id	Subspecies	Location	Deg. - WGS84		Biome	Ecoregion	Sample	Year	Source
			Latitude	Longitude					
Non-melanistic 478	*pardus*	Udzungwa Benjamin Drummond Mountains, Tanzania	-7,7762	36,6822	Tropical and Subtropical Moist Broadleaf Forests	Eastern Arc Montane Forests	Photograph	2011	Wildlife Conservation Society
Non-melanistic 479	*pardus*	Zanzibar, Tanzania	-6,0133	39,2655	Tropical and Subtropical Moist Broadleaf Forests	Northern Zanzibar-Inhambane coastal forest mosaic	Photograph	no data	Zanzibar Museum
Non-melanistic 480	*pardus*	Zanzibar, Tanzania	-5,9007	39,3223	Tropical and Subtropical Moist Broadleaf Forests	Northern Zanzibar-Inhambane coastal forest mosaic	Photograph	no data	Zanzibar Museum
Non-melanistic 481	*pardus*	Zanzibar, Tanzania	-5,9603	39,3396	Tropical and Subtropical Moist Broadleaf Forests	Northern Zanzibar-Inhambane coastal forest mosaic	Photograph	no data	Zanzibar Museum
Non-melanistic 482	*delacouri*	Huai Kha Khaeng Wildlife Sanctuary, Thailand	15,8022	99,7023	Tropical and Subtropical Dry Broadleaf Forests	Indochina dry forests	Photograph	2009	Kae Kawanishi
Non-melanistic 483	*delacouri*	Huai Kha Khaeng Wildlife Sanctuary, Thailand	15,4968	99,6261	Tropical and Subtropical Dry Broadleaf Forests	Indochina dry forests	Photograph	2009	Kae Kawanishi
Non-melanistic 484	*delacouri*	Huai Kha Khaeng Wildlife Sanctuary, Thailand	15,2545	98,7483	Tropical and Subtropical Moist Broadleaf Forests	Kayah-Karen/Tenasserim moist forests	Photograph	2012	Bruce Kekule
Non-melanistic 485	*delacouri*	Huai Kha Khaeng Wildlife Sanctuary, Thailand	14,7850	99,2517	Tropical and Subtropical Moist Broadleaf Forests	Kayah-Karen/Tenasserim moist forests	Photograph	2012	Bruce Kekule
Non-melanistic 486	*delacouri*	Huai Kha Khaeng Wildlife Sanctuary, Thailand	14,7850	99,2517	Tropical and Subtropical Moist Broadleaf Forests	Kayah-Karen/Tenasserim moist forests	Photograph	no data	Bruce Kekule
Non-melanistic 487	*delacouri*	Huai Kha Khaeng Wildlife Sanctuary, Thailand	15,5370	99,1422	Tropical and Subtropical Moist Broadleaf Forests	Kayah-Karen/Tenasserim moist forests	Photograph	2013	Bruce Kekule
Non-melanistic 488	*delacouri*	Huai Kha Khaeng Wildlife Sanctuary, Thailand	16,0221	98,6581	Tropical and Subtropical Moist Broadleaf Forests	Kayah-Karen/Tenasserim moist forests	Photograph	2013	Bruce Kekule
Non-melanistic 489	*delacouri*	Huai Kha Khaeng Wildlife Sanctuary, Thailand	15,5751	99,1429	Tropical and Subtropical Moist Broadleaf Forests	Kayah-Karen/Tenasserim moist forests	Photograph	2012	Wildlife Conservation Society
Non-melanistic 490	*delacouri*	Huai Kha Khaeng Wildlife Sanctuary, Thailand	15,0925	98,9792	Tropical and Subtropical Moist Broadleaf Forests	Kayah-Karen/Tenasserim moist forests	Photograph	2012	Wildlife Conservation Society
Non-melanistic 491	*delacouri*	Huai Kha Khaeng Wildlife Sanctuary, Thailand	14,7990	98,9247	Tropical and Subtropical Moist Broadleaf Forests	Kayah-Karen/Tenasserim moist forests	Photograph	2012	Wildlife Conservation Society
Non-melanistic 492	*delacouri*	Huai Kha Khaeng Wildlife Sanctuary, Thailand	14,8046	98,5320	Tropical and Subtropical Moist Broadleaf Forests	Kayah-Karen/Tenasserim moist forests	Photograph	2013	Wildlife Conservation Society
Non-melanistic 493	*delacouri*	Huai Kha Khaeng Wildlife Sanctuary, Thailand	14,3872	99,2542	Tropical and Subtropical Moist Broadleaf Forests	Kayah-Karen/Tenasserim moist forests	Photograph	2013	Wildlife Conservation Society
Non-melanistic 494	*delacouri*	Kaeng Krachan National Park, Thailand	12,8847	99,6302	Tropical and Subtropical Moist Broadleaf Forests	Kayah-Karen/Tenasserim moist forests	Photograph	no data	Bruce Kekule
Non-melanistic 495	*delacouri*	Kaeng Krachan National Park, Thailand	12,0023	99,6938	Tropical and Subtropical Moist Broadleaf Forests	Kayah-Karen/Tenasserim moist forests	Photograph	no data	Bruce Kekule
Non-melanistic 496	*delacouri*	Kaeng Krachan National Park, Thailand	12,9500	99,2334	Tropical and Subtropical Moist Broadleaf Forests	Kayah-Karen/Tenasserim moist forests	Photograph	no data	Bruce Kekule
Non-melanistic 497	*delacouri*	Kaeng Krachan National Park, Thailand	12,9500	99,2334	Tropical and Subtropical Moist Broadleaf Forests	Kayah-Karen/Tenasserim moist forests	Photograph	2009	Bruce Kekule
Non-melanistic 498	*delacouri*	Kaeng Krachan National Park, Thailand	13,0527	99,1907	Tropical and Subtropical Moist Broadleaf Forests	Kayah-Karen/Tenasserim moist forests	Photograph	2009	Bruce Kekule
Non-melanistic 499	*delacouri*	Kaeng Krachan National Park, Thailand	12,9500	99,2334	Tropical and Subtropical Moist Broadleaf Forests	Kayah-Karen/Tenasserim moist forests	Photograph	no data	Bruce Kekule
Non-melanistic 500	*delacouri*	Kaeng Krachan National Park, Thailand	13,3983	99,5686	Tropical and Subtropical Moist Broadleaf Forests	Kayah-Karen/Tenasserim moist forests	Photograph	2012	Bruce Kekule
Non-melanistic 501	*delacouri*	Kanchanaburi, Thailand	14,0507	99,5436	Tropical and Subtropical Moist Broadleaf Forests	Kayah-Karen/Tenasserim moist forests	Photograph	no data	Allwen Jesudasan
Non-melanistic 502	*delacouri*	Malay Peninsula, Thailand	13,1955	99,2677	Tropical and Subtropical Moist Broadleaf Forests	Kayah-Karen/Tenasserim moist forests	Photograph	2009	Kae Kawanishi
Non-melanistic 503	*delacouri*	Malay Peninsula, Thailand	12,9322	99,3147	Tropical and Subtropical Moist Broadleaf Forests	Kayah-Karen/Tenasserim moist forests	Photograph	2009	Kae Kawanishi
Non-melanistic 504	*saxicolor*	Sukavuşumu, Yusufeli County, Turkey	41,3611	42,1203	Temperate Broadleaf and Mixed Forests	Caucasus mixed forests	Photograph	1999	Igor Khorozian
Non-melanistic 505	*pardus*	Masindi, Uganda	1,7148	31,6919	Tropical and Subtropical Grasslands, Savannas and Shrublands	Victoria Basin forest-savanna mosaic	Photograph	1920	National Museum of Natural History USA
Non-melanistic 506	*pardus*	Murchison Falls National Park, Uganda	2,1606	31,5837	Tropical and Subtropical Grasslands, Savannas and Shrublands	Victoria Basin forest-savanna mosaic	Photograph	no data	Smithsonian Institution
Non-melanistic 507	*pardus*	Queen Elizabeth National Park, Uganda	-0,2880	29,9489	Tropical and Subtropical Grasslands, Savannas and Shrublands	Victoria Basin forest-savanna mosaic	Photograph	no data	Smithsonian Institution
Non-melanistic 508	*delacouri*	Plateau Du Kontum, Gia Lai-Kon Tum, Vietnam	13,9174	108,1171	Tropical and Subtropical Dry Broadleaf Forests	Indochina dry forests	Photograph	1963	National Museum of Natural History USA
Non-melanistic 509	*nimr*	Hawf Protected Area, Yemen	16,6663	44,4431	Deserts and Xeric Shrublands	Arabian Highlands woodlands and shrublands	Photograph	no data	David Stanton
Non-melanistic 510	*nimr*	Hawf Protected Area, Yemen	16,2698	43,2391	Deserts and Xeric Shrublands	Arabian Highlands woodlands and shrublands	Photograph	2011	David Stanton
Non-melanistic 511	*nimr*	Hawf Protected Area, Yemen	16,7597	44,1937	Deserts and Xeric Shrublands	Arabian Highlands woodlands and shrublands	Photograph	2011	David Stanton
Non-melanistic 512	*nimr*	Wada'i, Yemen	16,0167	43,8932	Deserts and Xeric Shrublands	Arabian Highlands woodlands and shrublands	Photograph	no data	Jane Budd
Non-melanistic 513	*nimr*	Wada'i Boundaries, Yemen	15,8774	43,6560	Deserts and Xeric Shrublands	Arabian Highlands woodlands and shrublands	Photograph	2002	Jane Budd
Non-melanistic 514	*pardus*	Akenge, Congo	-4,8484	21,9107	Tropical and Subtropical Grasslands, Savannas and Shrublands	Southern Congolian forest-savanna mosaic	Photograph	1913	American Museum of Natural History USA
Non-melanistic 515	*pardus*	Akenge, Congo	-4,6869	21,9299	Tropical and Subtropical Grasslands, Savannas and Shrublands	Southern Congolian forest-savanna mosaic	Photograph	1913	American Museum of Natural History USA
Non-melanistic 516	*pardus*	Bafuka, Haut, Congo	3,7467	28,6836	Tropical and Subtropical Grasslands, Savannas and Shrublands	Northern Congolian forest-savanna mosaic	Photograph	1911	American Museum of Natural History USA
Non-melanistic 517	*pardus*	Faradje, Haut, Congo	3,7022	29,7332	Tropical and Subtropical Grasslands, Savannas and Shrublands	Northern Congolian forest-savanna mosaic	Photograph	1911	American Museum of Natural History USA
Non-melanistic 518	*pardus*	Faradje, Haut, Congo	3,7022	29,7332	Tropical and Subtropical Grasslands, Savannas and Shrublands	Northern Congolian forest-savanna mosaic	Photograph	1911	American Museum of Natural History USA
Non-melanistic 519	*pardus*	Faradje, Haut, Congo	3,9682	29,6295	Tropical and Subtropical Grasslands, Savannas and Shrublands	Northern Congolian forest-savanna mosaic	Photograph	1911	American Museum of Natural History USA
Non-melanistic 520	*pardus*	Faradje, Haut, Congo	3,8220	29,5090	Tropical and Subtropical Grasslands, Savannas and Shrublands	Northern Congolian forest-savanna mosaic	Photograph	1911	American Museum of Natural History USA
Non-melanistic 521	*pardus*	Faradje, Haut, Congo	3,8220	29,5090	Tropical and Subtropical Grasslands, Savannas and Shrublands	Northern Congolian forest-savanna mosaic	Photograph	1911	American Museum of Natural History USA
Non-melanistic 522	*pardus*	Faradje, Haut, Congo	3,8220	29,5090	Tropical and Subtropical Grasslands, Savannas and Shrublands	Northern Congolian forest-savanna mosaic	Photograph	1911	American Museum of Natural History USA
Non-melanistic 523	*pardus*	Faradje, Haut, Congo	3,8032	29,9086	Tropical and Subtropical Grasslands, Savannas and Shrublands	Northern Congolian forest-savanna mosaic	Photograph	1911	American Museum of Natural History USA
Non-melanistic 524	*pardus*	Faradje, Haut, Congo	3,7623	29,9336	Tropical and Subtropical Grasslands, Savannas and Shrublands	Northern Congolian forest-savanna mosaic	Photograph	1911	American Museum of Natural History USA
Non-melanistic 525	*pardus*	Faradje, Haut, Congo	3,6523	29,8528	Tropical and Subtropical Grasslands, Savannas and Shrublands	Northern Congolian forest-savanna mosaic	Photograph	1911	American Museum of Natural History USA
Non-melanistic 526	*pardus*	Faradje, Haut, Congo	3,6523	29,8528	Tropical and Subtropical Grasslands, Savannas and Shrublands	Northern Congolian forest-savanna mosaic	Photograph	1911	American Museum of Natural History USA
Non-melanistic 527	*pardus*	Faradje, Haut, Congo	3,8000	29,6956	Tropical and Subtropical Grasslands, Savannas and Shrublands	Northern Congolian forest-savanna mosaic	Photograph	1911	American Museum of Natural History USA
Non-melanistic 528	*pardus*	Faradje, Haut, Congo	3,6790	29,6251	Tropical and Subtropical Grasslands, Savannas and Shrublands	Northern Congolian forest-savanna mosaic	Photograph	1911	American Museum of Natural History USA
Non-melanistic 529	*pardus*	Faradje, Haut, Congo	3,6790	29,6251	Tropical and Subtropical Grasslands, Savannas and Shrublands	Northern Congolian forest-savanna mosaic	Photograph	1911	American Museum of Natural History USA
Non-melanistic 530	*pardus*	Faradje, Haut, Congo	3,6271	29,6647	Tropical and Subtropical Grasslands, Savannas and Shrublands	Northern Congolian forest-savanna mosaic	Photograph	1911	American Museum of Natural History USA
Non-melanistic 531	*pardus*	Faradje, Haut, Congo	3,6271	29,6647	Tropical and Subtropical Grasslands, Savannas and Shrublands	Northern Congolian forest-savanna mosaic	Photograph	1911	American Museum of Natural History USA
Non-melanistic 532	*pardus*	Faradje, Haut, Congo	3,6271	29,6647	Tropical and Subtropical Grasslands, Savannas and Shrublands	Northern Congolian forest-savanna mosaic	Photograph	1911	American Museum of Natural History USA
Non-melanistic 533	*pardus*	Gamangui, Congo	3,6631	27,3678	Tropical and Subtropical Grasslands, Savannas and Shrublands	Northern Congolian forest-savanna mosaic	Photograph	1913	American Museum of Natural History USA
Non-melanistic 534	*pardus*	Madge, Congo	3,5396	27,0286	Tropical and Subtropical Grasslands, Savannas and Shrublands	Northern Congolian forest-savanna mosaic	Photograph	1914	American Museum of Natural History USA
Non-melanistic 535	*pardus*	Niapu, Congo	2,4361	26,4438	Tropical and Subtropical Moist Broadleaf Forests	Northeastern Congo Basin moist forests	Photograph	1913	American Museum of Natural History USA
Non-melanistic 536	*pardus*	Niapu, Congo	2,3027	26,4826	Tropical and Subtropical Moist Broadleaf Forests	Northeastern Congo Basin moist forests	Photograph	1913	American Museum of Natural History USA
Non-melanistic 537	*pardus*	Niapu, Congo	2,3001	26,2433	Tropical and Subtropical Moist Broadleaf Forests	Northeastern Congo Basin moist forests	Photograph	1913	American Museum of Natural History USA
Non-melanistic 538	*pardus*	Niapu, Congo	2,4914	26,3490	Tropical and Subtropical Moist Broadleaf Forests	Northeastern Congo Basin moist forests	Photograph	1913	American Museum of Natural History USA
Non-melanistic 539	*pardus*	Poko, Garamba, Congo	3,1303	26,9121	Tropical and Subtropical Grasslands, Savannas and Shrublands	Northern Congolian forest-savanna mosaic	Photograph	1913	American Museum of Natural History USA
Non-melanistic 540	*pardus*	Vankerckhovenville, Haut, Congo	3,0746	30,3358	Tropical and Subtropical Grasslands, Savannas and Shrublands	Northern Congolian forest-savanna mosaic	Photograph	1911	American Museum of Natural History USA
Non-melanistic 541	*pardus*	Chobe National Park, Zambia	-17,6599	25,2459	Tropical and Subtropical Grasslands, Savannas and Shrublands	Southern Miombo woodlands	Photograph	no data	Andrew Stein
Non-melanistic 542	*pardus*	Luangwa, Zambia	-15,6191	30,2616	Tropical and Subtropical Grasslands, Savannas and Shrublands	Zambezian and Mopane woodlands	Photograph	no data	Andrew Stein

Id	Subspecies	Location	Deg. - WGS84		Biome	Ecorregion	Sample	Year	Source
			Latitude	Longitude					
Non-melanistic 543	*pardus*	Luangwa, Zambia	-15,5797	30,3073	Tropical and Subtropical Grasslands, Savannas and Shrublands	Zambezian and Mopane woodlands	Photograph	no data	Andrew Stein
Non-melanistic 544	*pardus*	Luangwa, Zambia	-15,4602	30,2923	Tropical and Subtropical Grasslands, Savannas and Shrublands	Zambezian and Mopane woodlands	Photograph	no data	Andrew Stein
Non-melanistic 545	*pardus*	Luangwa, Zambia	-15,4425	30,1700	Tropical and Subtropical Grasslands, Savannas and Shrublands	Zambezian and Mopane woodlands	Photograph	no data	Andrew Stein
Non-melanistic 546	*pardus*	South Luangwa National Park, Zambia	-12,5524	31,7476	Tropical and Subtropical Grasslands, Savannas and Shrublands	Zambezian and Mopane woodlands	Photograph	no data	Bushcamp Project
Non-melanistic 547	*pardus*	South Luangwa National Park, Zambia	-12,6344	31,7317	Tropical and Subtropical Grasslands, Savannas and Shrublands	Zambezian and Mopane woodlands	Photograph	no data	Andrew Stein
Non-melanistic 548	*pardus*	Mashonaland, Zimbabwe	-16,5912	31,0548	Tropical and Subtropical Grasslands, Savannas and Shrublands	Southern Miombo woodlands	Photograph	1892	National Museum of Natural History USA
Non-melanistic 549	*pardus*	Ruaha National Park, Tanzania	-7,5826	34,3244	Tropical and Subtropical Grasslands, Savannas and Shrublands	Central Zambezian Miombo woodlands	Photograph	2012	WildCru
Non-melanistic 550	*pardus*	Welgevonden Game Reserve, South Africa	-24,3418	28,0210	Tropical and Subtropical Grasslands, Savannas and Shrublands	Southern Africa bushveld	Photograph	2011	Panthera
Non-melanistic 551	*pardus*	Welgevonden Game Reserve, South Africa	-24,3418	28,0210	Tropical and Subtropical Grasslands, Savannas and Shrublands	Southern Africa bushveld	Photograph	2011	Panthera
Non-melanistic 552	*orientalis*	Wangqing, China	43,0140	130,3603	Temperate Broadleaf and Mixed Forests	Manchurian mixed forests	Photograph	2010	World Wild Fund