UNIVERSIDADE FEDERAL DE LAVRAS

FERNANDA CRISTINA SOUZA

SEED AND FRUIT DISPERSAL TRAITS ACROSS BRAZILIAN BIOMES: EXPLORING TRENDS, PREDICTING, AND MAPPING ECOLOGICAL CORRELATES

LAVRAS – MG

2023

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Orientador

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Ficha catalográfica elaborada pelo Sistema de Geração de Ficha Catalográfica da Biblioteca Universitária da UFLA, com dados informados pelo(a) próprio(a) autor(a).

Souza, Fernanda Cristina.
Seed and fruit dispersal traits across Brazilian biomes : Exploring trends, predicting, and mapping ecological correlates / Fernanda Cristina Souza. - 2023.
142 p. : il.

Orientador(a): Bernard Josiah Barlow.
Coorientador(a): Renata Dias Françoso Brandão.
Tese (doutorado) - Universidade Federal de Lavras, 2023.
Bibliografia.

1. Dispersal traits. 2. Macroecology. 3. Community assembly. I. Barlow, Bernard Josiah. II. Brandão, Renata Dias Françoso. III. Título.

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CARACTERÍSTICAS DE DISPERSÃO DE SEMENTES E FRUTOS AO LONGO DOS BIOMAS BRASILEIROS: EXPLORANDO TENDÊNCIAS, PREDIZENDO E MAPEANDO CORRELATOS ECOLÓGICOS

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APROVADA em 31 de Agosto de 2023.
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2023

À todas as mulheres cientistas por seus esforços e contribuições fundamentais para o progresso do conhecimento e a construção de um futuro mais inclusivo e igualitário.

DEDICO

AGRADECIMENTOS

À minha família, por muitas vezes não entenderem minhas decisões, porém me apoiarem nesse longo processo que é o doutorado. Pais e avós por terem me dado a vida e acompanharem minha curiosidade pelas coisas da natureza desde criança. Meus irmãos por respeitarem minhas escolhas e limites. Meus sobrinhos João Pedro e Helena sementinhas no meu caminho.

Aos meus amigos de São João del-Rei, em especial Nath, Flaviana, Samara pela amizade de sempre e por sempre acreditarem em mim e ter paciência em escutar eu falar sobre ecologia!

Aos meus amigos e colegas de Lavras por terem me feito feliz na minha passagem por aí. Vanessa, que dividiu mais que um apê, além da amizade, dança, cafés, jantas, cachoeiras e lamentações. Ellen por propiciar o meu primeiro avistamento de lobo-guará no curso de campo e sua empática amizade. Matheus Mello e Paulo Henrique pelos pedais até a pedra Preta e conversas sobre pelos, penas, frutos e pegadas.

Aos colegas e amigos que fiz em Lancaster – Reino Unido. Ju, Leo, Pâmela, Lucas e Paulo. Obrigada pelas viagens, pedais, pubs, almoços, cafés, deixando o inverno menos rigoroso e o coração mais quentinho. Em especial ao Leonardo Miranda por ter me ajudado a criar o raster de primatas, Paulo por ter divido conversas, frustrações com a casa mais inusitada da cidade, cafés e ideias no LEC-03 e Pâmela por ter me ajudado a passar por uma crise de pânico longe de casa. Valeu casa em expansão!!

Aos colegas do Laboratório de Ecologia e Conservação da Flora, em especial Mateus Coutinho por fazer os layouts dos mapas e sempre estar disposto desde o início do doutorado a discutir ideias ecológicas em larga escala. Obrigada pela mútua colaboração.

Ao meu orientador Jos por aceitar a me orientar sem nem mesmo me conhecer e investir na formação científica de pesquisadores brasileiros. Obrigada pelas discussões, reuniões e pelo projeto mega desafiador. Grata também pela oportunidade de conhecer uma das maiores universidades do Reino Unido e pesquisadores que são referências mundiais em características de plantas. Com certeza, essas experiências foram muito além da tese aqui escrita e vou levá-las comigo e sentir orgulho da trajetória! Muito obrigada!

À minha coorientadora Renata por me acolher na UFLA, disponibilizando seu tempo para resolver burocracias, espaço físico e oportunidades no laboratório como coorientação de aluno de iniciação científica. Essas experiências somaram na minha formação acadêmica.

Às bancas de acompanhamento e qualificação que contribuíram com sugestões, críticas e conselhos para tese. Grata, Júlio Louzada, Renata Françoso, Eduardo Van den Berg. Em especial, a banca de defesa de doutorado pelas sugestões propostas e por aceitarem meu convite.

Bia e Laura por terem me ajudado a coletar, compilar e vasculhar várias formas e fontes para coleta e medições de sementes e frutos. Foram meses pandêmicos medindo, coletando, organizando, padronizando. Obrigada por acreditar no trabalho e se empenharam para a construção do banco de dados.

Ao Marc Van Rosmallen por reconhecer meu interesse genuíno na pesquisa e disponibilizar todos os volumes do livro *Wild fruits in the Amazon* de forma gratuita.

Ao Vinícius Maia pela disponibilidade em conversar e tirar dúvidas sobre random forest, quando eu já estava exausta de tentar mais uma abordagem de análise para os dados. Obrigada pela paciência e pela disponibilidade em responder minhas dúvidas diárias! Random forest me ensinou que além da ecologia, a vida de doutoranda não é nem um pouco linear e que isso faz parte do processo de aprendizagem.

À Maria Tereza, minha amiga e botânica predileta, por sempre estar disposta a ajudar com dúvidas botânicas sobre sementes e frutos. Grata!

Ao meu primo Lucas, por ter me ajudado no início, onde tudo era mato (rsrs), com manejo das mega planilhas no R. Obrigada por ter me apresentado o *dplyr*! Salvou meu tempo!

À rede de pesquisadores e todas as pessoas envolvidas na gestão e fornecimento de dados pelo forestplots.net. Obrigada pelos e-mails respondidos e pela permissão de uso de dados concedida. Em nome dos mais 200 pesquisadores, agradeço em especial Aurora, Oliver Philiphs e David Galbraith.

À Rede Amazônia Sustentável (RAS) pelos momentos de aprendizagem e discussão nas reuniões quinzenais. Com vocês pude aprender mais sobre a Amazônia e conhecer pesquisadores que me inspiram a continuar a trabalhar em prol da ciência, sustentabilidade e da floresta em pé. Obrigada também por propiciar minha primeira vivência de campo na maior floresta tropical do mundo.

Às universidades públicas, em especial Universidade Federal de São João del-Rei (UFSJ), onde minha jornada na ecologia começou, Universidade Federal de Minas Gerais (UFMG), onde eu comecei a interessar pelas interações animal-planta e Universidade Federal de Lavras (UFLA), aonde eu fui um pouco mais além! Obrigada Minas Gerais!

À Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES) pelo financiamento concedida durante os quatro anos mais desafiadores para a manutenção de bolsas no Brasil. O presente trabalho foi realizado com apoio da Coordenação de Aperfeiçoamento de Pessoal de Nível Superior – Brasil (CAPES) –Código de Financiamento 001.

A grant Arboles – A trait-based Understanding of LATAM Forest Biodiversity and Resilience por financiar o projeto e minha ida para a *Lancaster University.*

A todos que direta ou indiretamente contribuíram para que eu chegasse na finalização do doutorado, certamente uma das etapas mais desafiadoras em minha vida, MUITO OBRIGADA!!!

“Deus disse: Vou ajeitar a você um dom: Vou pertencer você para uma árvore. E pertenceu-me. Escuto o perfume dos rios. Sei que a voz das águas tem sotaque azul. Sei botar cílio nos silêncios. Para encontrar o azul eu uso pássaros. Só não desejo cair em sensatez. Não quero a boa razão das coisas. Quero o feitiço das palavras"

(Manoel de Barros)

RESUMO

Características de sementes e frutos são essenciais para várias funções ao longo do processo de regeneração das plantas. Apesar dessa notável importância, tais características têm sido pouco compreendidas em relação às características de folhas e raízes. Por exemplo, ainda não se sabe como as características associadas à dispersão de sementes e frutos covariam entre floras de diferentes ambientes e estratégias de dispersão. Além disso, há falta de congruência sobre os principais fatores ecológicos que predizem suas distribuições. Assim, essas lacunas foram abordadas a partir da coleta de informações de características de sementes e frutos e variáveis ambientais de 301 parcelas de vegetação antiga (*old-growth*) e não-alagáveis distribuídas nos quatro maiores biomas brasileiros (Amazônia, Mata Atlântica, Cerrado e Caatinga). No capítulo 1, foram exploradas relações entre características morfológicas de sementes e frutos a nível de espécie, diferenciando-as entre biomas e/ou modos de dispersão. No segundo capítulo, foi investigada a distribuição dos modos de dispersão e da massa das sementes a nível de comunidade e identificado os principais fatores climáticos, edáficos e de agentes de dispersão que predizem a dominância dos modos de dispersão mais comuns e do tamanho das sementes. No primeiro capítulo, observou-se que o espectro morfológico das sementes é dividido em dois componentes principais que representam as características de tamanho (massa da semente e dimensões de sementes e frutos) e o número de sementes por unidade reprodutiva. Esses dois componentes de variação foram mantidos independente dos biomas e modos de dispersão. No entanto, a massa das sementes dispersas pelo vento variou de forma independente das características de tamanho de sementes e frutos dentro dos biomas (exceto na Amazônia). No segundo capítulo, o clima, em termos de sua variação e níveis de precipitação, foi o principal fator em predizer a dominância da massa das sementes e dos modos de dispersão, seguido pelas propriedades do solo ou agentes de dispersão. Em relação às hipóteses ecológicas, a hipótese da disponibilidade de recursos não foi bem apoiada na previsão da distribuição dos modos de dispersão. No entanto, a distribuição de espécies dispersas pelo vento foi prevista pela velocidade média anual do vento (hipótese de disponibilidade de dispersores), enquanto as espécies com sementes pesadas aumentaram em dominância sob condições climáticas tipicamente encontradas em ambientes sombreados e solos mais densos (hipótese de recrutamento). Novos avanços são necessários para obter uma compreensão mais profunda dos mecanismos subjacentes às complexas relações entre os frugívoros e a dominância de espécies dispersas por animais. Por fim, discuto as implicações dos meus resultados em ajudar a antecipar como as mudanças climáticas futuras e os distúrbios antrópicos impactarão o funcionamento dos ecossistemas.

Palavras-chave: Agentes de dispersão. Anemocoria. Biomas brasileiros. Clima. Dispersão de sementes. Florestas tropicais. Frutos. Massa das sementes. Modos de dispersão. Solo

ABSTRACT

Seeds and fruit traits are essential for numerous functions along the plant regeneration process. Despite their remarkable importance, such traits have been poorly understood concerning leaf and root traits. For instance, it is still unknown how dispersal seed and fruit traits covary within different environments and dispersal strategies. Furthermore, there is a lack of congruence regarding the key ecological factors shaping the distribution of seed dispersal traits. Thus, I address these knowledge gaps by gathering seed and fruit traits and environmental variables from 301 old-growth vegetation plots across the four largest Brazilian biomes (Amazon, Atlantic Forest, Cerrado, and Caatinga). In Chapter 1, I explored relationships for a set of six morphological traits (seed mass, seed and fruit width and length, and seed number) at the species level, differentiating them among biomes and/or dispersal modes. In the second chapter, I examined the distribution of dispersal modes and seed mass across Brazilian biomes and identified the main climatic, edaphic, and dispersal agent factors that predict the dominance of the most common dispersal modes and seed mass. In the first chapter, I found that the morphological seed and fruit spectrum is divided into two principal components that represent the size traits (seed mass and seed and fruit dimensions) and the seed number per reproductive unit. These two components of variation are maintained regardless of biomes and dispersal modes. However, I observed that seed mass from wind-dispersed species varied independently of size traits within biomes (except in the Amazon). In the second chapter, I found that climate, in terms of its variation and precipitation levels, was the primary factor in predicting the dominance of seed mass and dispersal modes, followed by soil properties or dispersal agents.
Regarding the ecological hypotheses, the resource-availability hypothesis was not well-supported in predicting the distribution of dispersal modes. However, the distribution of wind-dispersed species was predicted by the mean annual wind speed (disperser-availability hypothesis), while heavy-seeded species increased under conditions typically found in shade environments (recruitment-hypothesis) and poor soils in terms of bulk density. New advances are needed to gain a deeper understanding of the mechanisms underlying the complex relationships between frugivores and the dominance of animal-dispersed species. Finally, I discuss the implications of my results in helping anticipate how future climate changes and anthropogenic disturbances will impact ecosystem functioning.

Keywords: Anemochory. Brazilian biomes. Climate. Dispersal agents. Dispersal mode. Fruits. Seed dispersal. Seed mass. Soil. Tropical forest

SUMÁRIO

PRIMEIRA PARTE

INTRODUÇÃO GERAL

A diversidade de formas, estruturas e estratégias de vida historicamente impulsionou a classificação dos organismos em grupos com base em suas semelhanças morfológicas e formas de vida (CADOTTE; CARSCADDEN; MIROTCHNICK, 2011; WEITHER et al., 2009). Embora as abordagens baseadas em características sejam tradicionalmente conhecidas, elas foram tardiamente incorporadas aos estudos ecológicos. Até a década de 90, o principal foco de estudo da biodiversidade era baseado na abordagem taxonômica das espécies (HOOPER et al., 2005). No entanto, essa abordagem pode ser limitada quando se deseja investigar mudanças na composição de espécies em ecossistemas diante de alterações ambientais. Assim, ao conhecer as características das espécies (do inglês *traits*), pode ser possível prever quais delas aumentarão ou diminuirão em decorrência das mudanças ambientais, bem como seus impactos em processos ecossistêmicos (DÍAZ et al., 2013; FUKAMI et al., 2005).

Trait pode ser definido como qualquer característica morfológica, bioquímica, fisiológica, fenológica, estrutural ou comportamental medida no nível individual, sendo funcional quando tem impacto aparente no fitness dos organismos, ou seja, no crescimento, na reprodução ou na sobrevivência (VIOLLE et al., 2007). Podem ser características de resposta (*response traits*) ao permitir que os organismos respondam ao estresse ou a diferentes condições ambientais (bióticas ou abióticas). Além disso, as características de efeito refletem os efeitos (*effect traits*) dos organismos nos níveis tróficos (ex: interação predador-presa) e nas propriedades e serviços ecossistêmicos (ex: ciclagem de nutrientes). Nesse caso, não precisam necessariamente ter impacto no fitness dos organismos (DÍAZ et al., 2013).

Recursos são limitados, levando as espécies a enfrentarem *trade-offs*. Isso significa que a alocação de recursos em uma característica essencial para sua história de vida pode reduzir o investimento em outra igualmente crucial para seu fitness. Nesse contexto, o conceito de *trade-off* se torna valioso ao explicar como as espécies lidam com a demanda conflitante de onde investir recursos em contextos de restrições ambientais e competição interespecífica. Um dos primeiros sistemas propostos para distinguir as estratégias das espécies por meio de *trade-offs* é a seleção r/K. A seleção *r/K* (MACARTHUR; WILSON, 1967; PIANKA, 1970) foi inicialmente proposta para prever mudanças nas estratégias dos organismos em um gradiente de competição. Essa teoria sugere que indivíduos sob baixa competição apresentariam estratégias que favoreceriam sua reprodução nos estágios iniciais de vida (*r*-estrategistas), enquanto indivíduos de populações sob alta competição tenderiam a minimizar a reprodução e investir em características associadas à aquisição de recursos (*k*-estrategistas). Essas ideias subjacentes à teoria da seleção *r/K* foram posteriormente expandidas em teorias que incorporam eixos associados aos gradientes de estresse e distúrbio (GRIME; PIERCE, 2012; WESTOBY, 1997; PIERCE et al., 2017)

Com o advento de extensivos bancos de dados sobre características de plantas (e.g TRY *Plant Trait Database*) nos últimos anos, juntamente com as análises multivariadas já bem consolidadas (ex: PCA), tem sido possível correlacionar várias características importantes para a aptidão das plantas de forma simultânea, quantificando suas covariâncias e *trade-offs* (DÍAZ et al., 2016; JOSWING et al., 2022). Em uma abordagem global, múltiplos *trade-offs* foram explorados por meio de análises multivariadas compreendendo seis características essenciais para a sobrevivência, reprodução e crescimento das plantas vasculares. A ordenação dessas características no espaço dimensional revela uma alta densidade de características concentradas, indicando *trade-offs* e coordenação entre características. Em um plano bidimensional, a maior variação das características foi capturada pelo eixo associado ao tamanho da planta inteira e dos órgãos (*size spectrum*), e o segundo eixo de maior variação foi associado às características econômicas das folhas (*economic spectrum*). O espectro econômico está relacionado com a forma que as plantas, por meio de características específicas, adquirem ou conservam recursos, refletindo, por um lado, os custos fotossintéticos de construção das folhas e, por outro, os investimentos em crescimento (DÍAZ et al., 2016; WESTOBY, 1998).

Embora características das folhas tenham sido amplamente exploradas ao longo do espectro econômico da folha (DÍAZ et al., 2016; JOSWING et al., 2022; WESTOBY, 1998), características das sementes têm recebido menor atenção (exceto a massa das sementes). No espectro global da forma e função das plantas, a massa das sementes varia com o tamanho máximo da planta ao longo do espectro do tamanho e reflete o *trade-off* entre a massa e o número de sementes (DÍAZ et al., 2016; GARNIER et al., 2016). Assim, o *trade-off* massa-número representa, por um lado, o investimento na produção de grandes e poucas sementes, cada uma com grandes chances de sobreviver nos estágios iniciais de recrutamento, e, por outro lado, o investimento na produção de muitas e pequenas sementes cada uma delas com alta capacidade de dispersão e colonização e maiores chances de apresentar dormência e formar banco de sementes persistentes (DÍAZ et al., 2016).

Evidências crescentes sugerem que sementes grandes apresentam alta chance de sobrevivência nos estágios iniciais de recrutamento em contextos de perigos ("*hazards*") ambientais (seca, sombreamento, competição) (LEBRIJA-TREJOS et al., 2016; WESTOBY; LEISHMAN; LORD, 1996; LEISHMAN et al., 2000). No entanto, dados empíricos têm mostrado que essa vantagem não é grande o suficiente para compensar a alta produção de sementes por árvores de sementes pequenas. Basicamente, o forte *trade-off* (relação isométrica negativa) entre tamanho e número de sementes se dá ao nível de sementes produzidas por unidade de área da copa da planta por ano. Porém, o tamanho médio das sementes é positivamente associado ao tamanho máximo da planta (DÍAZ et al., 2016). Assim, espécies com sementes grandes são produzidas por árvores maiores, que consequentemente possuem uma área de copa maior para produzir sementes. Ainda assim, espécies com maior massa de sementes tendem a ter uma vida reprodutiva mais longa, produzindo sementes por muito mais tempo do que espécies de sementes pequenas (MOLES; WESTOBY, 2004). Por outro lado, sementes grandes demoram mais tempo para chegar à idade reprodutiva do que sementes pequenas, o que poderia levar suas plântulas a serem expostas a longos períodos de mortalidade juvenil até chegar à vida adulta (MOLES; WESTOBY, 2004). Portanto, *o trade-off* entre muitas sementes pequenas, cada uma com baixa sobrevivência, e poucas sementes grandes com maior sobrevivência, pode não ser tão isométrico assim quando se consideram características de história de vida das plantas, como o tamanho, longevidade e tempo até a primeira reprodução (MOLES, 2018).

Embora haja incentivo para o estudo das estratégias de sobrevivência das sementes a partir de suas características de história de vida (*life-history spectrum*), ainda existem importantes fronteiras na ecologia funcional de sementes para serem preenchidas (MOLES, 2018; SAATKAMP et al., 2019). Nesse contexto, permanece desconhecido como as várias características das sementes podem refletir funções e estratégias ecológicas. Recentemente, um framework conceitual foi proposto a fim de integrar características de sementes em funções ecológicas (dispersão, estabelecimento, persistência, *timing* de germinação), importantes para o processo de regeneração das plantas (SAATKAMP et al., 2019). Este estudo identifica conjuntos de características associadas à morfologia, fisiologia e bioquímica das sementes que potencialmente podem ser exploradas a fim de compor o espectro ecológico das sementes. Características associadas ao tamanho da semente já foram foco de vários estudos, porém suas relações e *trade-offs* considerando diferentes ambientes e estratégias de dispersão ainda necessitam ser investigadas. Diferenciar as características morfológicas de sementes nesses dois níveis pode ajudar a compreender como a história de vidas das plantas e o ambiente influenciam as estratégias de recrutamento de plantas em contextos de mudanças ambientais e esforços de restauração.

As características funcionais das plantas, principalmente folhas e caules, têm sido cada vez mais utilizadas para compreender como as espécies respondem a diferentes gradientes ambientais (DWYER; HOBBS; MAYFIELD, 2014; SWENSON; ENQUIST, 2007). Esses gradientes são definidos por mudanças graduais nos fatores abióticos ao longo do tempo e espaço, sendo úteis para determinar os limites fisiológicos das espécies, também conhecidos como ótimo ambiental (VIOLLE et al., 2007). No entanto, a distribuição de uma espécie ao longo de um gradiente não reflete apenas o resultado do efeito direto do gradiente ambiental na capacidade da espécie de crescer (nicho fundamental), mas também é influenciada pelas interações com outras espécies (nicho realizado) (McGILL et al., 2006). Na escala local, tanto as restrições abióticas quanto as interações bióticas podem determinar quais características conferem maior vantagem adaptativa às espécies e, consequentemente, quais delas são mais propensas a coexistir. Da mesma forma, espécies com características menos adequadas podem ser excluídas, resultando na redução de sua persistência e estabelecimento nas comunidades locais em face das restrições ambientais (DÍAZ et al., 2013; KRAFT et al., 2014). Mudanças na composição funcional das comunidades em resposta aos gradientes ambientais têm sido investigada através das médias das características das espécies que coocorrem em um determinado local, ponderada por sua abundância relativa (Community Weighted Means - CWM) (MUSCARELLA et al., 2017).

Mudanças nas características de sementes ao longo dos trópicos têm sido investigadas principalmente considerando biomas únicos, com foco principal nas florestas tropicais e neotropicais (ALMEIDA-NETO et al., 2008; CORREA; ÁLVAREZ.; STEVENSON, 2015; CORREA et al., 2022; PINHO et al., 2021). No Brasil, mais especificamente, ainda há poucos estudos que englobam gradientes ambientais que incluam comunidades em biomas sazonalmente secos e savanas (TABERELLI et al., 2003). Além disso, muito do conhecimento sobre como sistemas de dispersão e tamanho de semente respondem aos gradientes ambientais está associado ao clima (MALHADO et al., 2015; PINHO et al., 2021; TABERELLI et al., 2003). No entanto, ainda existem evidências limitadas que suportem o papel da fertilidade do solo e de agentes de dispersão em larga escala espacial (TER STEEGE et al., 2006; CORREA; ÁLVAREZ.; STEVENSON, 2015; CORREA et al., 2022). Por exemplo, ainda não foram identificadas as propriedades do solo mais importantes para prever a distribuição das características de dispersão de sementes. Além disso, o papel dos frugívoros na ocorrência dos sistemas de dispersão zoocóricos ainda não foi completamente compreendido (CORREA; ÁLVAREZ.; STEVENSON, 2015; CORREA et al., 2022). Por fim, e não menos importante, tem-se assumido de forma implícita que as relações entre gradientes ambientais e características das plantas são lineares; no entanto, mudanças abruptas nessas relações podem ocorrer devido às restrições fisiológicas impostas por extremos ambientais (MOLES, 2018).

Nesse sentido, busquei preencher essas lacunas de conhecimento explorando primeiramente o espectro morfológico de sementes e frutos em larga escala espacial, englobando floras dos quatro maiores biomas brasileiros e modos de dispersão predominantes. O Brasil abrange uma notável diversidade de formações geológicas e tipos de vegetação, apresentando seis biomas (ou domínios fitogeográficos) oficialmente reconhecidos. Os quatro maiores incluem a Floresta Amazônica, Mata Atlântica, Cerrado (savana brasileira) e Caatinga (floresta tropical sazonalmente seca) (MMA, 2021). Após investigar como as características de sementes e frutos covariam ao nível de espécie, associei o modo de dispersão e a massa das sementes das espécies a suas abundâncias relativas ao longo de gradientes ambientais a fim de predizer suas dominâncias. A tese está dividida em dois capítulos escritos na forma de artigos científicos. No primeiro capítulo, busquei entender como um conjunto de características morfológicas de sementes e frutos se relacionam e se essas relações se mantêm entre floras de diferentes biomas e estratégias de dispersão. Para isso, eu usei dados de 1659 espécies provenientes de 256 parcelas de vegetação antiga (*old-growth*) distribuídas na Amazônia, Mata Atlântica, Cerrado e Caatinga. Eu discuti as principais tendências com base no *trade-off* bem conhecido entre tamanho e número de sementes. No segundo capítulo, investiguei quais os fatores ecológicos são mais importantes para predizer a distribuição dos modos de dispersão e da massa das sementes. Para esse objetivo, eu usei como variável resposta a abundância proporcional dos modos de dispersão predominantes e médias da massa das sementes ponderadas pela abundância da comunidade (CWM). Como variáveis explicativas, eu utilizei variáveis de clima, solo e de agentes de dispersão (biomassa de espécies de primatas frugívoros e velocidade do vento). Aqui, eu discuti as principais tendências considerando o papel de cada grupo de preditor em prever a dominância das características de dispersão de sementes e suas implicações em suportar três hipóteses ecológicas não mutuamente exclusivas: hipótese da disponibilidade de recursos, hipótese da disponibilidade dos agentes de dispersão e hipótese de recrutamento. A partir dessas hipóteses, eu forneço algumas considerações sobre os fatores subjacentes que podem influenciar a dominância de características de dispersão ao longo dos biomas brasileiros. Por fim, eu discuto potenciais implicações dos resultados em ajudar a prever a resposta das plantas em contextos de mudanças ambientais.

CONCLUSÃO GERAL

Nessa tese, eu abordo lacunas de conhecimento sobre as características de sementes e frutos essenciais para a regeneração das plantas, caracterizando suas variações e predizendo suas dominâncias sob gradientes ecológicos nos quatro maiores biomas brasileiros. No primeiro capítulo, preencho lacunas referentes ao espectro morfológico de sementes e frutos ao identificar relações consistentes entre floras de diferentes biomas e estratégias de dispersão. No segundo, identifico o clima como principal fator ecológico em predizer a dominância da massa das sementes e dos modos de dispersão mais comuns, seguido pelas propriedades do solo ou agentes de dispersão.

Além de identificar os fatores ecológicos que predizem a dominância das características de dispersão de sementes, este estudo fornece considerações relevantes sobre fatores subjacentes às hipóteses ecológicas testadas. A hipótese da disponibilidade de recursos não parece ser suficiente para explicar os mecanismos que sustentam a distribuição dos modos de dispersão na escala de biomas brasileiros. No entanto, a distribuição de espécies dispersas pelo vento pode ser prevista pela velocidade média anual do vento (hipótese de disponibilidade de dispersores), enquanto as espécies com sementes pesadas podem ser favorecidas sob condições climáticas tipicamente encontradas em ambientes sombreados e solos mais densos (hipótese de recrutamento). Novos avanços são necessários a fim de desenvolver uma compreensão mais completa sobre os processos que sustentam a dominância dos modos de dispersão zoocóricos em ecossistemas tropicais. Essas hipóteses devem incluir predições que levam em conta a variação do tamanho das sementes dentro dos modos de dispersão, mudanças no tipo de vegetação dentro e entre biomas, escala de estudo e a influência indireta do clima na fertilidade do solo.

Os dois capítulos fornecem importantes implicações para a regeneração das plantas e o funcionamento dos ecossistemas diante das mudanças ambientais em curso. Identificar os eixos de covariação e os *trade-offs* entre as características morfológicas das sementes pode subsidiar estudos futuros que buscam compreender como as funções de dispersão e estabelecimento responderão aos impactos crescentes sobre a vegetação. Além disso, considerando que o funcionamento dos ecossistemas é determinado pela dominância de características, os resultados dessa tese podem informar e antecipar como as mudanças climáticas futuras e os distúrbios antrópicos (e.g. fragmentação, perda de habitat) impactarão o funcionamento da vegetação. Por exemplo, árvores de sementes pequenas, as quais tendem a desempenhar um papel limitado em relação à retenção de carbono, podem dominar as comunidades em cenários de alta instabilidade climática previstos pelas mudanças climáticas e por distúrbios antrópicos na vegetação. De forma geral, as características das sementes variam amplamente dentro dos biomas brasileiros, sendo, portanto, importantes em predizer a dominância de características de dispersão de sementes ao longo de gradientes ecológicos e sua resposta potencial às mudanças ambientais futuras.

REFERÊNCIAS

ALMEIDA-NETO, M. et al. Vertebrate dispersal syndromes along the Atlantic Forest: Broad-scale patterns and macroecological correlates. **Global Ecology and Biogeography**, v. 17, n.4, p. 503-513, 2008.

CADOTTE, M. W.; CARSCADDEN, K.; MIROTCHNICK, N. Beyond species: Functional diversity and the maintenance of ecological processes and services Journal of Applied Ecology, **Journal of Applied Ecology**, v. 48, n. 5, 1079–1087, 2011.

CORREA, D. F.; ÁLVAREZ, E.; STEVENSON, P. R. Plant dispersal systems in neotropical forests: Availability of dispersal agents or availability of resources for constructing zoochorous fruits? **Global Ecology and Biogeography**, v. 24, n.2, p. 203–214, 2015.

CORREA, D.F. et al. Geographic patterns of tree dispersal modes in Amazonia and their ecological correlates. **Global Ecology and Biogeography**, v. 32, n.1, p. 49–69, 2022.

DÍAZ, S. et al. Functional traits, the phylogeny of function, and ecosystem service vulnerability. **Ecology and Evolution**, v. 3, n. 9, p. 2958–2975, 2013.

DÍAZ, S. et al. The global spectrum of plant form and function. **Nature**, v. 529, n. 7585, p. 167-171, 2016.

DWYER, J. M.; HOBBS, R. J.; MAYFIELD, M. M. Specific leaf area responses to environmental gradients through space and time. **Ecology**, v. 95, p. 399–410, 2014.

GRIME, J. P; PIERCE, S. The evolutionary strategies that shape ecosystems. John Wiley & Sons, 2012.

FUKAMI, T.; BEZEMER, M.; MORTIMER, S.; VANDER PUTTEN, W. H. Species divergence and trait convergence in experimental plant communities. **Ecology Letters**, v. 8, n.12, p. 1283-1290, 2005.

HOOPER, D. U. et al. Effects of biodiversity on ecosystem functioning: a consensus of current knowledge. **Ecological Monographs**, v. 75, n.1, p. 3–35, 2005.

JOSWIG, J. S. et al. Climatic and soil factors explain the two-dimensional spectrum of global plant trait variation. **Nature Ecology and Evolution,** v. 6, n.1, p. 36–50, 2022.

KRAFT, N. J. B. et al. Community assembly, coexistence and the environmental filtering metaphor. **Functional Ecology**, v. 29, n. 5, p. 592–599, 2015.

LAVOREL, S.; GARNIER, E. Predicting the effects of environmental changes on plant community composition and ecosystem functioning: revisiting the Holy Grail. **Functional Ecology**, v. 16, n.1, p. 545–556, 2002.

LEBRIJA-TREJOS, E.; REICH, P. B.; HERNÁNDEZ, A.; WRIGHT, S. J. Species with greater seed mass are more tolerant of conspecific neighbours: A key driver of early survival and future abundances in a tropical forest. **Ecology Letters**, v. 19, n.9, p. 1071–1080, 2016.

LEISHMAN, M.R. et al. The evolutionary ecology of seed size. In: **Seeds: the ecology of regeneration in plant communities**. Wallingford UK: CABI publishing, 2000. p. 31-57.

MACARTHUR, R. H.; WILSON, E. O. The Theory of Island Biogeography. 1. ed. Princeton: Princeton University Press, 1967.

MALHADO, A. et al. Climatological correlates of seed size in Amazonian Forest trees. **Journal of Vegetation Science**, v. 26, n.5, p. 956–963, 2015**.**

McGILL, B. J.; ENQUIST, B. J.; WEIHER, E.; WESTOBY, M. Rebuilding community ecology from functional traits. **Trends in Ecology & Evolution**, v. 21, n.4, p. 178–185, 2006.

MOLES, A. T.; WESTOBY, M. Seedling survival and seed size: A synthesis of the literature. **Journal of Ecology**, v. 92, n.3, p. 372–383, 2004.

MOLES, A. T. Being John Harper: using evolutionary ideas to improve understanding of global patterns in plant traits. **Journal of Ecology**, v. 106, n. 1, p. 1–18, 2018.

MMA - Ministério do Meio Ambiente. (2021). Biomas. Disponível em: https://antigo.mma.gov.br/biomas.html. Acesso em: 23 out. 2023.

MUSCARELLA, R. et al. Demographic drivers of functional composition dynamics. **Ecology**, v. 98, n.11, p. 2743–2750, 2017.

PIANKA, E. R. On r- and K-Selection. The American Naturalist, v. 104, p. 592–597, 1970.

PIERCE, S. et al. A global method for calculating plant CSR ecological strategies applied across biomes world-wide. **Functional Ecology**, v. 31, n. 2, p. 444–457, 2017.

PINHO, B. X. et al. Functional biogeography of Neotropical moist forests: Trait–climate relationships and assembly patterns of tree communities. **Global Ecology and Biogeography**, v. 30, n.7, p. 1430–1446, 2021.

SAATKAMP, A. et al. A research agenda for seed-trait functional ecology. **New Phytologist**, v. 221, n.4, p. 1764–1775, 2019.

SWENSON, N. G.; ENQUIST, B. J. Ecological and evolutionary determinants of a key plant functional trait: Wood density and its community-wide variation across latitude and elevation. **American Journal of Botany**, v. 94, p. 451-459, 2007.

TABARELLI, M.; VICENTE, A.; BARBOSA, D. Variation of seed dispersal spectrum of woody plants across a rainfall gradient in North-Eastern Brazil. **Journal of Arid Environments**, v. 53, n.2, p. 197–210, 2003.

TER STEEGE, H. et al. Continental-scale patterns of canopy tree composition and function across Amazonia. **Nature**, v. 443, p. 444–447, 2006.

VIOLLE, C.; NAVAS, M.-L.; VILE, D.; KAZAKOU, E.; FORTUNEL, C.; HUMMEL, I.; GARNIER, E. Let the concept of trait be functional! **Oikos**, v. 116, n.5, p. 882–892, 2007.

WEIHER, E. et al. Challenging Theophrastus: a common core list of plant traits for functional ecology. **Journal of Vegetation Science**, v. 10, n. 5, p. 609–620, 2009.

WESTOBY, M.; LEISHMAN, M.; LORD, J. Comparative ecology of seed size and dispersal. **Philosophical Transactions of the Royal Society of London B**, v. 351, n.1345, p. 1309–1318, 1996.

WESTOBY, M. A leaf-height-seed (LHS) plant ecology strategy scheme. **Plant and Soil**, v. 199, n.2, p. 213–227, 1998.

WRIGHT, I. J. et al. The worldwide leaf economics spectrum. **Nature**, v. 428, n. 6985, p. 821–827, 2004.

SEGUNDA PARTE (ARTIGOS)

ARTIGO 1

Morphological seed and fruit traits spectrum: a comparative analysis among biomes and dispersal modes

Este artigo está formatado nas normas do periódico *Journal of Vegetation Science* (versão preliminar)

Morphological seed and fruit traits spectrum: a comparative analysis among biomes and dispersal modes

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Funding information

This study was supported by UK Natural Environment Research Council (NERC) Arboles, grant number NE/S011811/1

Abstract

Aims

Seed and fruit traits are essential to understand the establishment and dispersal functions along the plant regeneration process. However, these traits have only recently been incorporated into the global spectrum of plant and form function. Still, the relationships between morphological seed and fruit traits among biomes and dispersal modes remain unclear.

Methods

Here, we explored morphological seed and fruit traits correlations for 1658 plant species distributed among the four largest Brazilian biomes. We clustered trait-trait Pearson correlations and represented these correlations on principal component analysis (PCA). The strength of the relationships between traits among biomes and/or dispersal modes was investigated using Fisher's *z* test.

Results

We found that most seeds and fruit variations were captured by the first two axes. PC1 was described by the size traits (e.g., seed mass, seed, and fruit dimensions), and PC2 was described by seed number per reproduction unit (number of seeds within diaspores unit). These distinct groups were maintained when the analyses were carried out for each biome or dispersal mode. The main differences in the seed/fruit traits relationships emerged when analysing wind-dispersed species among biomes.

Conclusions

The main difference in morphological seed and fruit trait variations emerge when seed and fruit relationships are differed within biomes and dispersal modes. Our findings shed light on potential factors, such as phylogenetic and physical constraints, driving these variations within different biomes and dispersal modes. Recognizing these patterns and exceptions is important for generating hypotheses in future studies on the evolution of fruit and seed morphology**.**

Keywords: anemochory, Brazilian biomes, comparative analysis, dispersal modes, fruit size, seed mass, seed size, seed size-number trade-offs, seed morphological spectrum

Introduction

Functional traits have been a crucial currency for understanding the evolution of plant life strategies (Westoby, 1998), plant community assembly (Pinho et al., 2021), and ecosystem functioning (Freshet et al., 2021). The six main critical traits for the fitness of global vascular plants have been described along two principal axes of variation, focusing on the size spectrum and the leaf economic spectrum (Díaz et al., 2015). Yet, there has been much less information on seed and fruit traits that are essential for main regeneration functions Morphological seed and fruit traits, such as size and number, are essential to characterize two key dimensions of the regeneration niche underpinning dispersal and establishment functions (Saatkamp et al., 2019). Seed dispersal traits define how seeds can travel through biotic and abiotic dispersal vectors, reaching sites for survival, germination, and seedling establishment. These sites include favourable conditions for adult regeneration or unfavourable matrices leading to spatially restricted habitats due to competitive exclusion (Howe & Smallwood, 1982; Saatkamp et al., 2019). Seed establishment traits play an essential role in the successful recruitment of individuals into a population. Since these traits can indicate how seeds explore and occupy sites, as well as the likelihood of seedling emerge and establishment, they help us predict plant responses to environmental changes. Therefore, morphological seed and fruit traits are consistent with their central importance in plant ecology and evolution and help us understand how dispersal and establishment functions will change with increasing impact on vegetation and ecosystems (Galetti et al., 2013; Johnson et al., 2019).

Seed and fruit traits are understudied in plant ecology concerning leaf and root traits (Wright et al. 2004; Mommer & Weemstra, 2012). Where they have been used, most attention has been focussed on seed mass, which has been used together with plant height to explain the to explain the spectrum of the size of whole plants and organs into the global spectrum of the plant form and function (Díaz et al. 2015). Seed mass is an essential trait for many aspects of plant regeneration. For instance, seed mass placing species along an axis that reflects the trade-off between seedling survival versus dispersal ability (Smith & Fretwell, 1974). Thus, seed mass trade-off represents, on the one hand, the many small seeds output with more likely to exhibit dormancy and form persistent seed banks and on the other hand, the few large seeds output with a higher chance of success in the early stage of recruitment (Thompson et al. 1998; Moles & Westoby, 2006; Rubio de Casas et al. 2017). Beyond seed mass-number trade-offs, there are numerous other relationships among seed and fruit traits that could play a significant functional or role. Fruit size and seed load have been closely associated, and their combinations can determine specific interactions with seed dispersers, which are important for the establishment of dispersal syndromes (or dispersal modes) (Rojas et al. 2022). In turn, the dispersal mode is often defined by a set of morphological diaspore traits that indicate an affinity for specific dispersal vectors, such as wind, water, or animals (Howe & Smallwood, 1982; Van der Pijl, 1982). In addition, the negative allometry between seed length and width in diaspores dispersed by gut of animals and wind supports the idea that seed, and fruit dimensions have been modified through interactions with seed dispersal agent (Stevenson et al., 2023). Overall, these morphological seed traits relationships play a pivotal role in avoiding negative density dependent effects by facilitating the movement of diaspores away from the parent plant and enabling the successful recruitment of individuals after seed germination.

While there have been advances in our understanding of these individual traits and their coordination and trade-offs, the relationships between morphological seed and fruit traits among different ecosystems and dispersal strategies remain unclear. For instance, dispersal mode is one of the main plant attributes shaping the evolution and global distribution of seed mass (Moles et al. 2005a; Moles et al. 2007), but its influence on other seed and fruit traits is poorly understood. Furthermore, it is not clear to what extent these relationships are consistent across different biomes, where plant traits result from a complex interaction of climate, soil and disturbance regimes with physiognomies characterized by the form and function of dominant species (Moncrieff et al. 2016). Understanding these relationships can be helpful in elucidating the consistency of trade-offs and evaluating to what extent data on some traits could be inferred from others. Advancing this understanding of the seed and fruit morphological spectrum can address future questions about seed ecology and evolution by shedding light the main drivers in the evolution of fruit and seed morphology.

We address these knowledge gaps by collating and evaluating morphological seed and fruit traits for 1658 plant species distributed across the four largest Brazilian biomes. Brazil encompasses a remarkable diversity of geological formations and vegetation types, featuring six officially recognized biomes (or phytogeographic domains). The four largest ones include the Amazon Forest, Atlantic Forest, Cerrado (Brazilian savanna), and Caatinga (seasonal tropical dry forest) (MMA, 2021). Our study is driven by two primary aims. First, we investigate the relationships between morphological seed and fruit traits within the Brazilian flora, while considering to what extent these variations in the relationships are driven by different biomes and dispersal modes. Second, we examine explore the strength of the relationships between dispersal traits across biomes and dispersal modes. For this aim, we have a clear a priori prediction for seed size-number relationships, due to the widely known seed mass-number trade-offs (negative correlation) that underpin dispersal and establishment function.

Methods

Study site and vegetation data

We used a dataset comprised of 2115 species and morphospecies (identified at genus level) from 256 plots distributed in four Brazilian biomes. All plots were located on old-growth vegetation plots and non-flooded soils. Forest inventories were carried out by a network of researchers who stored data in the forestplots.net database - a repository to measure, monitor, and understand mainly the world's tropical forests (Lopez-Gonzalez et al. 2009; ForestPlots.net et al. 2021). While other floristic data is available, the forest plots inventory has the advantage of covering many species across different biomes. In addition, the forest plot dataset undergoes rigorous quality checks, ensuring the reliability of its data. Thus, all these advantages are valuable resources to achieve our study goals.

We established some criteria to include species data: (i) tree and shrubs species (excluding herbs, lianas, and bamboos species) (ii) species that were classified into the most common dispersal modes; (iii) species that provided measurements for all traits; (iv) species records from predominant vegetation types from each biome according to the forestplots.net database. The main vegetation type from each biome included: moist forest (Amazon and Atlantic Forest), semideciduous forest (Atlantic Forest), savannas (Cerrado sensu stricto), dry forest (Caatinga). We considered semideciduous and moist forest to account species composition in Atlantic Forest as both forests have shown evident similarity in tree compositions (Silva de Miranda et al. 2018). In total, 149 species were common to two or more biomes, but their inclusion did not affect the main trend (Figure 1; Appendix S1). Thus, we worked with 1807 records from 1658 species and morphospecies (77 families, 284 genera) distributed in Amazon (n=1219), Atlantic Forest (n=347), Cerrado (n=136), and Caatinga (n=105). For dispersal modes, we worked with records from endozoochorous (n=1232), anemochorous (n=251) and synzoochorous (n=175) species. Finally, we verified and standardized species and families' nomenclature using Flora do Brasil 2020 (Brazil Flora Group 2021).

Seed and fruit traits

We worked with endozoochorous, anemochorous, and synzoochorous species as they cover a wide range of seed and fruit traits and represent the most common dispersal modes in our dataset (~90% of total number of species). These seed dispersal modes were compiled through scientific literature (books, scientific papers, and theses) and online databases (Seed Information Database). Endozoochory was assigned to fleshy diaspores with small to large seeds dispersed through the gut of animals. Anemochory was allocated to diaspores without fleshy structures carried by the wind. Synzoochory was designated for fleshy or dry diaspores with large seeds carried externally through the body of bats, monkeys (primary dispersal), or scatter hoarders (secondary dispersal) (Van Rosmallen, 2013; Kuhlmann & Ribeiro, 2016). All dispersal modes were assigned at the genus level only when there were no variations in dispersal modes within species of the same genus.

We collected morphological seed and fruit traits from herbarium collections, scientific literature, online databases and description of species and genera from the REFLORA program (Flora e Funga do Brasil - http://floradobrasil.jbrj.gov.br/). In total, we included 9.422 records (4.209 fruits; 5.213 seeds) of individual specimens collecting six traits: fruit and seed dimensions (length and width), seed mass, and seed number. The dimensions of the fruits and seeds were measured from online herbarium platforms such as the JABOT and Species link and compiled from literature sources, online databases, and RFELORA. Seed mass was mainly extracted from global databases, such as TRY Plant Trait Database (Kattge et al. 2020), BIEN Botanical Information and Ecology Network and Seed information database (SID; Royal Botanic Gardens Kew, 2020) and from literature sources. The seed number was compiled mainly from literature and REFLORA. Further seed and fruit traits (except seed number) were obtained from personal communication (Appendix S2). Species and genus-level records were represented by a single value for each trait, which is the median value of all records contained in our dataset. Since fruit and seed size are traits that tend to be conserved along the phylogenetic tree (Fuzessy et al. 2021), we used trait median values at the genus level for species without trait information.

Curation of the dataset

We prioritized data compilation from dry fruits and seeds. When dry materials were not available, fresh measurements (mass and dimensions) were converted to dry measurements using the following correction factor: dry measurements= $[0.92 \text{ x fresh measurements}]^{0.94}$ (Moles et al. 2005b). For unknown sources regarding the type of material (whether dry or fresh), we excluded values that exceeded the 90th percentile from the median of species. In addition, we excluded duplicate traits from the database (for example, similar trait values from different databases). Thus, we avoided including replicated data, fresh materials, and extreme values from unknown sources.

Data analyses

To identify the main trends in seed and fruit trait relationships, we correlated species traits using Pearson's correlation coefficient and clustered these coefficients pairwise using a hierarchical clustering algorithm (Galilli et al. 2018). All six traits were log-transformed (log +1 for seed number) to homogenize variable distribution and projected in Principal Component Analysis (PCA) using the R package *FactoMineR*, which scales data automatically (Lê et al. 2008).

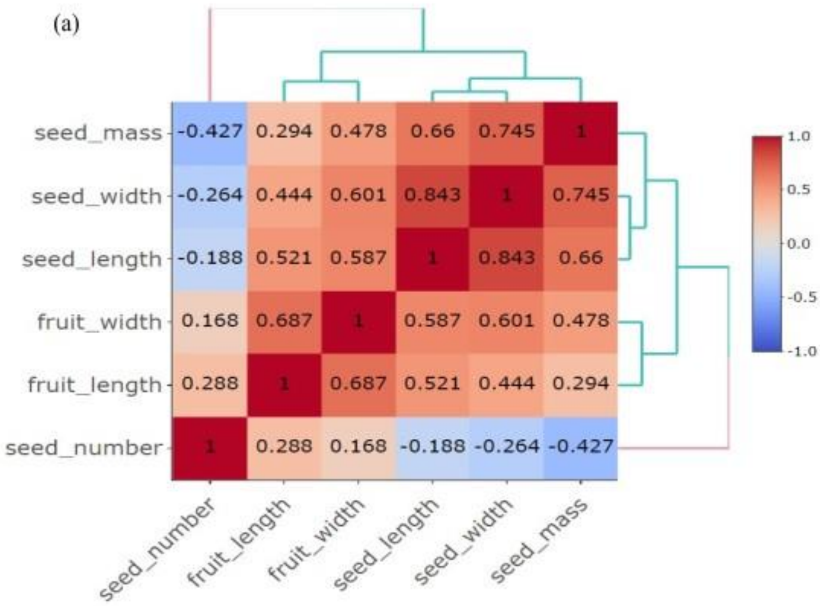
To assess whether variation in seed and fruit trait relationships within the entire dataset were consistent among biomes and dispersal modes, we performed PCAs and correlations matrix separately for species from each biome and dispersal mode. To investigate whether the strength of the relationships between seed mass and seed number shifts between dispersal modes and biomes, we compared the correlation coefficients using Fisher's z test implemented in the *'cocor.indep. groups'* function in the R package *cocor* (Diedenhofen & Much, 2015). Finally, we analysed the dataset by dispersal mode and biome to identify whether the main differences in variation axes and correlation coefficients are due to specific dispersal modes from each biome.

Results

Main trend

The first two principal components of the PCA analysis represented 81.8% of the total variation. The hierarchical clustering analysis split seed and fruit traits into two groups: (1) size-related traits consisting of seed mass, seed length, seed width, fruit length and fruit width and (2) number trait comprising only by seed number per reproduction unit. (Figure 1a). PC1 described the group of size traits and accounted for 56.5% of the variance; PC2 described the seed number per reproduction unit and accounted for 25.3% of the variance (Figure 1b, c; Appendix S3). The group of size traits contained two subclusters. The first was represented by seed size-related traits (seed mass, seed width, and seed length). The second was represented by fruit-size relate traits including fruit width and length. Fruit length took an intermediate position between size and number traits but was more closely cluster with the group of size traits. Thus, across all systems, the most strongly correlated pairings of traits were seed length and seed width, followed by seed mass and seed width, and fruit length and fruit width. These pairings were more strongly correlated than those between seed number and any other seed and fruit traits (Figure 1a).

(a)



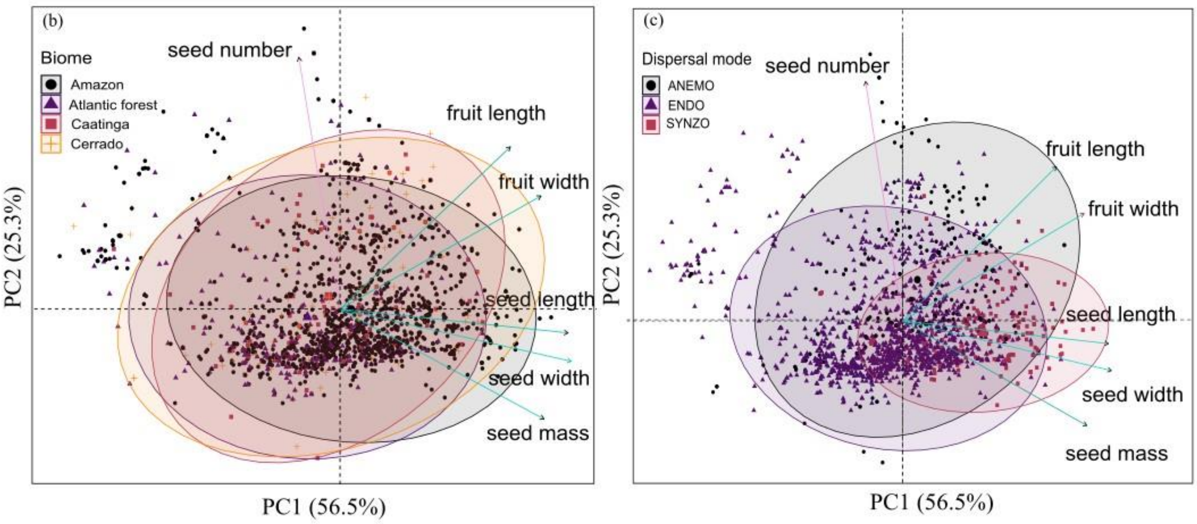


Figure 1: Seed and fruit traits relationships for 1658 species from 1807 records. **a:** Heatmap of covariation: Correlated traits are indicated using Pearson correlation coefficients, with dark red colour indicating positive correlation and light blue colour indicating negative correlation. Two distinct groups are shown: (1) size-related traits: seed mass, seed width, seed length, and fruit width (cyan group); (2) seed number per reproduction unit (pink line) **b, c:** PCAs are represented by the first two components. Each dot represents one specie. Ellipses colours indicate different biomes in **b** and dispersal modes in **c**. The ellipses correspond to 0.95 quantiles.

Biomes and dispersal modes

The two dominant trait axes remained consistent when the analyses were carried out for each biome and dispersal mode (Appendix S3-S5). In addition, the two main axes were maintained for endozoochorous species regardless of biomes (Appendix S6-S7). However, seed mass of anemochorous species was not maintained along the same variation components in all biomes. Specifically, seed mass from Atlantic Forest, Cerrado, and Caatinga species showed considerable variance along PC2 rather than PC1. Thus, PC1 was described by seed and fruit dimensions which accounted for ~45-56% of the total variance, and PC2 was described by seed mass, which accounted for ~20-26% of the total variance. The seed number took an intermediate position between PC1 and PC2 (Fig 2a-h; Appendix S8). Finally, anemochorous species from the Amazon showed similar results to the main trend. Thus, seed mass covaried with seed and fruit dimensions, accounting for 49.1% of the total variation along PC1 whereas

PC2 was defined by seed number, explaining for 26% of the total variation (Fig 2 a-b; Appendix S8).

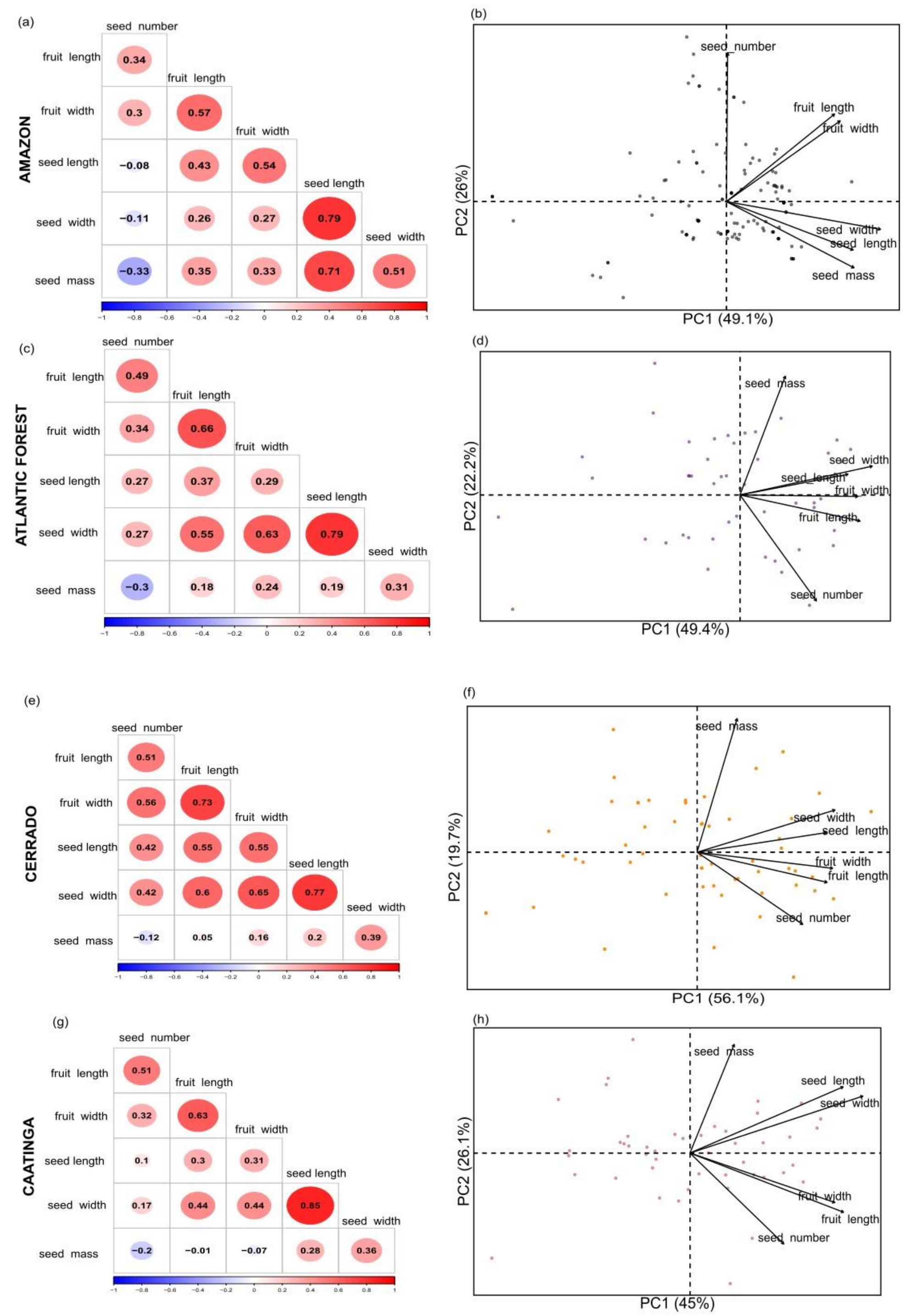


Figure 2: Seed and fruit traits relationships for anemochorous species from Amazon (A-B; n=137), Atlantic Forest (C-D; n=52), Cerrado (D-E; n=55), and Caatinga (F-G; n=47). **(a), (c), (e), (g):** Pearson correlation coefficients with red colour indicating positive correlations and blue colour indicating negative correlations. Large disk size show strong correlations and small

size disk show weak correlations. Non-significant correlation at $p<0.05$ are shown by blank colour. (**b), (d), (f), (h)**: PCAs are represented by the first two components. Arrows indicate the direction and weighting of the trait vectors. The dots represent each anemochorous species/morphospecies from Amazon (black), Atlantic Forest (purple), Cerrado (orange), and Caatinga (pink).

Seed mass-number relationships

Seed mass and seed number were negatively correlated across all systems, with correlations ranging from weak to moderate (Table 1). When comparing the pairwise correlation coefficients between biomes, we observed that seed mass-number relationships in Amazon and Atlantic Forest species were 21% and 23% stronger than those in Caatinga species, respectively. On the other hand, Cerrado species did not exhibit significant differences in seed mass-number relationships when compared to the other biomes.

Considering the pairwise correlation coefficients between dispersal modes, we found that endozoochorous species showed seed mass-number relationships that were 16% and 20% stronger than those of synzoochorous and anemochorous species. More specifically, endozoochorous species from the Amazon and Atlantic Forest showed seed mass-number relationships that were 25% and 27% stronger than those of endozoochorous species from the Caatinga. We observed no significant differences in seed mass-number relationships among anemochorous species from each biome (Table 1).

Table1: Fisher's z-test comparing pairwise Pearson correlation coefficients between seed mass and seed numbers among biomes and (A), dispersal modes (B) and separately by biome and dispersal mode (C-D). The test was performed between two correlations coefficients based on independent groups (biomes and/or dispersal modes). Amazon (AM); Atlantic forest (AF); Cerrado (CE); Caatinga (CA); Endozoochory (ENDO); Synzoochory (SYNZO); Anemochory (ANEMO).

(a) Biome	**AM-AF**	**AM-CE**	**AM-CA**	**AF-CE**	**AF-CA**	**CA-CE**
Pearson correlation	(-0.44) (-0.46)	(-0.44) (-0.34)	(-0.44) (-0.22)	(-0.44) (-0.34)	(-0.46) (-0.22)	(-0.22) (-0.34)
z	0.33	-1.26	-2.4	-1.32	-2.37	-1.06
p-value	0.73	0.2	**0.01**	0.18	**0.01**	0.31
(b) Dispersal mode	**ENDO-SYNZO**	**ENDO-ANEMO**	**ANEMO-SYNZO**			
Pearson correlation	(-0.44) (-0.24)	(-0.44) (-0.28)	(-0.28) (-0.24)			
z	-2.9	-2.69	-0.5			
p-value	**0**	**0.01**	0.62			
(c) Dispersal mode/ biome	**ENDO (AM-AF)**	**ENDO (AM-CE)**	**ENDO (AM-CA)**	**ENDO (AF-CE)**	**ENDO (AF-CA)**	**ENDO (CA-CE)**
Pearson correlation	(-0.45) (-0.48)	(-0.45) (-0.45)	(-0.45) (-0.20)	(-0.48) (-0.45)	(-0.48) (-0.20)	(-0.20) (-0.45)
z	0.5	-0.02	-2	-0.28	-2.12	-2.54
p-value	0.61	0.97	**0.00**	0.77	**0.03**	0.12
(d) Dispersal mode/biome	**ANEMO (AM-AF)**	**ANEMO (AM-CE)**	**ANEMO (AM-CA)**	**ANEMO (AF-CE)**	**ANEMO (AF-CA)**	**ANEMO (CA-CE)**
Pearson correlation	(-0.33) (-0.29)	(-0.33) (-0.11)	(-0.33) (-0.19)	(-0.29) (-0.11)	(-0.29) (-0.19)	(-0.19) (-0.11)
z	-0.23	-1.39	-0.81	-0.94	-0.49	0.41
p-value	0.81	0.16	0.41	0.34	0.62	0.67

Discussion

Our study indicates two main groups of traits; the first is related to size traits (e.g., seed mass, seed, and fruit dimensions), and the second is the single-variable group that includes the seed number per reproduction unit. Most of these variations between traits were consistent within biomes and dispersal modes, with the main differences in seed and fruit morphological spectrum related to anemochorous species across biome. Seed mass from Atlantic Forest, Cerrado, and Caatinga showed no dependence to size, represented by the first axis, while Amazonian seeds showed consistent covariation between mass and size.

Understanding variation in the relationships between dispersal traits

Empirical evidence has shown that the main two axes of the plant form and function spectrum are maintained, regardless of differences in climate, scale of study, plant functional attributes, and flora richness (Bruelheide et al. 2018; Thomas et al. 2020; Joswig et al. 2022). Furthermore, on continental and global scales, seed size is more strongly associated with plant attributes than environmental conditions (Westoby, 1996; Moles et al., 2007). However, our findings showed that the main differences in seed/fruit trait relationships emerged when we analysed species within each biome and dispersal modes. There are a few reasons why this may be the case. The first is a sample bias in the number of sites, that may have led to stochastic variation related to the small species pool. For instance, seed mass varied independently of other seed and fruit traits in the Atlantic Forest, Cerrado, and Caatinga. However, these biomes exhibited the lowest number of species in our dataset, which could be solely due to stochastic variations and not the main trend among anemochorous species within each biome. The second point is the differential role of certain dispersal modes in some biomes. Anemochorous species from the Amazon, which represents the largest species pool for anemochorous species in our dataset, showed covariation between seed mass and seed and fruit size along the main axis of variation. Specific taxa may be driving this distinct trend in the Amazon, primarily the predominant families with large seed and fruit sizes (e.g., *Lecythidaceae, Fabaceae, and Apocynaceae*). This distinct trend among anemochorous species in the Amazon, could confer an adaptive advantage for coping with the deep shade conditions typically found in closed-canopy forest (Westoby et al., 1996; Eriksson et al., 2000). To investigate this further, we encourage future studies to investigate the relationships between the dispersal traits of Amazon species, differentiating them among the predominant phylogenetic groups. Finally, our study has shown that understanding variations in dispersal trait relationships goes beyond exploring their main trends within biomes and dispersal modes. The main difference emerged when distinguishing variations in morphological seed and fruit traits within anemochorous species across different biomes.

Why strong seed size and number trade-offs were not identified

Across all systems, seed number showed weak to moderate correlations with seed size. Similarly, recent studies have recognized seed number as a distinct component in seed and fruit morphological variation, which is not constrained by a restrictive trade-off with seed size (Joswig et al., 2022). The large amount of variation in seed size and number within species and across communities could influence the magnitude of these relationships. For instance, in our dataset, seed mass exhibited a wide range of variation, spanning up to six orders of magnitude, where distinct large-seeded species were observed to produce both a high and low number of seeds per reproduction unit. This wide variation allows for multiple potential explanations. We focused on the seed output at the organ level, but it is important to point out that a strong seed mass and number trade-off is commonly expected when accounting for the seed production per unit of plant canopy area per year (Moles, 2018). Therefore, the seed output per reproductive unit may not fully reflect the overall variations and investment in seed production at the plant canopy level throughout the year, resulting in weaker correlations with seed mass.

Dispersal strategies that exhibit extreme trait values could also weaken the correlations. For instance, synzoochorous seeds were the largest seeds, with relatively little variation in seed number produced, whereas anemochorous seeds were the smallest but exhibit a wide range in seed number produced. These intrinsic variations may lead to less linear seed mass-number relationships. Furthermore, weaker seed mass-number relationships were observed in Caatinga species regardless of their dispersal modes (whether endozoochory or anemochory). This weak relationship may have been influenced by the smaller sample sizes within the Caatinga species, which could lead to an increased probability of stochastic variation and, thus, not reflect the expected population estimates. Overall, our findings suggest that strong seed size-number relationships can potentially be constrained by organ-level seed production, life-history traits such as dispersal modes, or stochastic variation due to small samples size.

Implications for including dispersal traits in large-scale assessments of plant form and function

Our study shows that there is considerable variation in plant dispersal traits with each biome and dispersal modes, and that only a small portion of these is captured by seed mass. This could be an important consideration when observing how ecosystems respond to environmental changes or predicting restoration trajectories, as in both cases plant recruitment is fundamental. For example, when seed mass data is not available for a range of zoochorous species across different environments, seed size could be inferred through seed dimensions (mainly seed width). This trend would be useful for monitoring different forest recovery trajectories based on seed traits, with implications for seed dispersal and mutualistic networks (Hawes et al., 2020). Still, quantifying and understanding the axes of seed and fruit variations can be essential to predict plant regeneration response under changes in climate and land use (Joswing et al., 2022). Finally, integrating this morphological seed and fruit spectrum with other axes of seed trait covariation associated with dormancy and germination phenology as well as persistence could be essential to characterize key dimensions of the regeneration niche on different environments conditions.

Conclusion

Overall, the variations in morphological seed and fruit traits relationships are expressive within biome and dispersal mode. Although we found consistent of these relationships along the main two main axes of variations, the main differences emerge when considering variations in seed and fruit traits within wind-dispersed species among biomes. Our outcomes offer new insights into potential factors, including phylogenetic and physical constraints, which could drive the variations in the relationships between morphological seed and fruit traits within biomes and dispersal modes. Identifying these trends and exceptions in seed and fruit trait variations could be important for developing hypotheses for future studies that aim to investigate the main drivers in the evolution of fruit and seed morphology.

Acknowledgements

We are grateful to the UK Natural Environment Research Council (NE/S011811/1) for financial support. FCS would like to thank the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior – Brasil (CAPES) – Finance Code 001 for the PhD scholarship. We are deeply thankful for everyone involved in field collection, identification, and data curation from vegetation inventories. We also thank all Brazilian herbarium collections for providing and organizing online materials. This publication is based on Research Project number 98 of the ForestPlots.net global collaboration ‘Mapping reproductive traits across South American biomes’.

Author contributions

F.C.S and J.B conceived of the research idea; F.C.S, A.B.L, L.E and forestplot.net collected data; F.C.S. performed statistical analyses; F.C.S and J.B led the writing of the manuscript.

Data availability statement

The dispersal modes and seed and fruit traits based on 1,658 species and morphospecies are also included as Supporting Information (Appendix II).

References

Brazil Flora Group. (2021) *Brazilian Flora 2020 project - Projeto Flora do Brasil 2020. Version 393.274*. Instituto de Pesquisas Jardim Botânico do Rio de Janeiro. Dataset/Checklist. Available at http://floradobrasil.jbrj.gov.br/ [Accessed 30 July 2023]

Bruelheide, H., Dengler, J., Purschke, O., Lenoir, J., Jiménez-Alfaro, B., Hennekens, S. M., Botta-Dukát, Z. et al. (2018) Global trait–environment relationships of plant communities. *Nature Ecology and Evolution,* 2, 1906–1917. https://doi.org/10.1038/s41559-018-0699-8

Díaz, S., Kattge, J., Cornelissen, J. H., Wright, I. J., Lavorel, S., Dray, S., Reu, B., Kleyer, M. et al. (2016) The global spectrum of plant form and function. *Nature*, 529, 167–171. https://doi.org/10.1038/nature16489

Diedenhofen, B. & Musch, J. (2015) A Comprehensive Solution for the Statistical Comparison of Correlations. *PLoS ONE* 10, 1–12. https://doi.org/10.1371/journal.pone.0121945

Eriksson, O., Friis, E.M. & Löfgren, P. (2000) Seed size, fruit size, and dispersal systems in angiosperms from the Early Cretaceous to the Late Tertiary. *American Naturalist, 156*, 47–58. https://doi.org/10.1086/303367

ForestPlots.net., Blundo, C., Carilla, J., Grau, R., Malizia, A., Osinaga-Acosta, O., Bird.M., Bradford, M. et al. (2021) Taking the pulse of Earth’s tropical forests using networks of highly distributed plots. *Biological Conservation, 260*, 1–27.

https://doi.org/10.1016/j.biocon.2020.108849

Freschet, G.T., Roumet, C., Comas, L.H., Weemstra, M., Bengough, A.G., Rewald, B., Bardgett, R.D., De Deyn, G.B. et al. (2021) Root traits as drivers of plant and ecosystem functioning: current understanding, pitfalls and future research needs. *The New phytologist*, 232, 1123–1158. https://doi.org/10.1111/nph.17072

Fuzessy, L., Silveira, F.A.O., Culot, L., Jordano, P. & Verdu, M. (2021) Phylogenetic congruence between neotropical primates and plants is driven by frugivory. *Ecology Letters*, 25, 320–325. https://doi.org/10.1111/ele.13918

Galetti, M., Guevara, R., Côrtes, M. C., Fadini, R., Von Matter, S., Leite, A. B., Labecca, F. et. al. (2013) Functional extinction of birds drives rapid evolutionary changes in seed size. *Science*, 340, 1086-1090. https:// doi.org/ 10.1126/science.1233774

Galili, T., O'Callaghan, A., Sidi, J., Sievert, C. (2018) heatmaply: an R package for creating interactive cluster heatmaps for online publishing. *Bioinformatics*, 34, 1600–1602. https://doi.org/10.1093/bioinformatics/btx657

Lopez-Gonzalez, G., Lewis, S.L., Burkitt, M., Baker T.R. and Phillips, O.L. (2009) *ForestPlots.net Database*. Available at www.forestplots.net [Accessed 30 July 2023]

Hawes, J., Vieira, I., Magnago, L., Berenguer, E., Ferreira, J., Aragão, L., Cardoso, A., Lees, A., Lennox, G. et.al. (2020) A large-scale assessment of plant dispersal mode and seed traits across human-modified Amazonian forests. *Journal of Ecology*, 108, 1373-1385. https://doi.org/10.1111/1365-2745.13358

Howe, F. & Smallwood, J. (1982) Ecology of seed dispersal. *Annual review of ecology and systematics,* 13, 201–228. https://doi.org/10.1146/annurev.es.13.110182.001221

Johnson, J.S., Cantrell, R.S., Cosner, C., Hartig, F., Hastings, A., Rogers, H.S., Schupp, E.W., Shea, K., Teller, B.J. et al. (2019) Rapid changes in seed dispersal traits may modify plant responses to global change. *AoB PLANTS*, 11, 1–20. https://doi.org/10.1093/aobpla/plz020

Joswig, J.S., Wirth, C., Schuman, M.C., Kattge, J., Reu, B., Wright, I.J., Sippel, S.D. et.al. (2022) Climatic and soil factors explain the two-dimensional spectrum of global plant trait variation. *Nature Ecology and Evolution*, 6, 36–50. https://doi.org/10.1038/s41559-021-01616-8

Kattge, J., Bönisch, G., Díaz, S., Lavorel, S., Prentice, I. C., Leadley, P., …Wirth, C. (2020) TRY plant trait database - enhanced coverage and open access. *Global Change Ecology*, 26, 119–188. https://doi.org/10.1111/j.1365-2486.2011.02451.x

Kuhlmann, M.& Ribeiro, J.F. (2016) Evolution of seed dispersal in the Cerrado biome: ecological and phylogenetic considerations. *Acta Botanica Brasilica, 30,* 271-282. https://doi.org/10.1590/0102-33062015abb0331

Lê, S., Josse, J., Husson, F. (2008) FactoMineR: A Package for Multivariate Analysis. *Journal of Statistical Software*, 25, 1–18. https://doi.org/10.18637/jss.v025.i01.

Liu, Y., Walck, J.L., El-Kassaby, Y.A. (2017) Roles of the environment in plant life history trade-off*s*. In: Jimenez-Lopez JC. (Eds), *Advances in seed biology*. IntechOpen: London, UK, pp. 3-24.

MMA - Ministério do Meio Ambiente. (2021) Biomas. Available at https://antigo.mma.gov.br/biomas.html

Moles, A.T., Ackerly, D.D., Webb, C.O., Twiddle, J.C., Dickie, J.B. & Westoby, M. (2005a) A brief history of seed size. *Science*, 307, 576–580. https://doi.org/10.1126/science.1104863

Moles, A. T., Ackerly, D. D., Webb, C. O., Tweddle, J. C., Dickie, J. B., Pitman, A. J., & Westoby, M. (2005b) Factors that shape seed mass evolution. *Proceedings of the National Academy of Sciences of the United States of America*, 102, 10540–10544. https://doi.org/10.1073/pnas.0501473102

Moles, A.T. & Westoby, M. (2006) Seed size and plant strategy across the whole life cycle. *Oikos*, 113, 91–105. https://doi.org/10.1111/j.0030-1299.2006.14194.x

Moles, A.T., Ackerly, D.D., Tweddle, J.C., Dickie, J.B., Smith, R., Leishman, M.R., Mayfield, M.M. et.al. (2007) Global patterns in seed size. *Global Ecology and Biogeography*, 16, 109–116. https://doi.org/10.1111/j.1466-8238.2006.00259.x

Moles, A.T. (2018) Being John Harper: using evolutionary ideas to improve understanding of global patterns in plant traits. *Journal of Ecology*, 106, 1–18. https://doi.org/10.1111/1365-2745.12887

Mommer, L. & Weemstra, M. (2012) The role of roots in the resource economics spectrum. *New Phytologist*, 195, 725–727. https://doi.org/10.1111/j.1469-8137.2012.04247.x

Moncrieff, G.R., Bond, W.J. & Higgins, S.I. (2016) Revising the biome concept for understanding and predicting global change impacts. *Journal of Biogeography*, 43, 863–873. https://doi.org/10.1111/jbi.12701

Parolin, P., Wittmann, F., & Ferreira, L.V. (2013) Fruit and seed dispersal in Amazonian floodplain tress - A review. *Ecotropica*, 19, 15–32. https://doi.org/10.1002/ecy.2642

Pinho, B.X., Tabarelli, M., ter Braak, C.J.F., Wright, S.J., Arroyo-Rodríguez, V., Benchimol, M., Engelbrecht, B.M.J. et.al. (2021) Functional biogeography of Neotropical moist forests: Trait–climate relationships and assembly patterns of tree communities. *Global Ecology and Biogeography*, 30, 1430–1446. https://doi.org/10.1111/geb.13309 https://doi.org/10.1038/s41467-022-30037

Rojas, T. N., Zampini, I. C., Isla, M. I., & Blendinger, P. G. (2022) Fleshy fruit traits and seed dispersers: Which traits define syndromes? *Annals of Botany*, 129, 831–838. https://doi.org/10.1093/aob/mcab150

Rees, M. (1993) Trade-offs among dispersal strategies in British plants. *Nature*, 366, 150–152. https://doi.org/10.1038/366150a0

Rubio de Casas, R., Willis, C. G., Pearse, W. D., Baskin, C. C., Baskin, J. M., & Cavender-Bares, J. (2017) Global biogeography of seed dormancy is determined by seasonality and seed size: a case study in the legumes. *The New phytologist*, 214, 1527–1536. https://doi.org/10.1111/nph.14498

Saatkamp, A., Cochrane, A., Commander, L., Guja, L.K., Jimenez-Alfaro, B., Larson, J., Nicotra, A. et.al. (2019) A research agenda for seed-trait functional ecology. *New Phytologist*, 221, 1764–1775. https://doi.org/10.1111/nph.15502

Silva de Miranda, P. L., Oliveira-Filho, A., Pennington, R. T., Neves, D. M., Baker, T. R., & Dexter, K. G. (2018) Using tree species inventories to map biomes assess their climatic overlaps in lowland tropical South America. *Global Ecology and Biogeography*, 27, 899-912. https://doi.org/10.1111/geb.12749

Smith, C.C., & Fretwell, S.D. (1974) The Optimal Balance between Size and Number of Offspring. *The American Naturalist*, 108, 499–506. https://doi.org/10.1086/282929

Stevenson, P.R., Acosta-Rojas, D.C., Cárdenas, S., Henao-Díaz, LF. (2023). Variation in fruit and seed dimensions is better explained by dispersal system than by leaf size in a tropical rainforest. American Journal of Botany, 110, 1-3. https://doi.org/10.1002/ajb2.16211

Thomas, H. J. D., Bjorkman, A. D., Myers-Smith, I. H., Elmendorf, S. C., Kattge, J., Diaz, S., Vellend, M. et.al. (2020) Global plant trait relationships extend to the climatic extremes of the tundra biome. *Nature communications*, 11 1351. https://doi.org/10.1038/s41467-020-15014-4

Thompson, K.A., Bakker, J.P., Bekker, R.M., & Hodgson, J.G. (1998) Ecological correlates of seed persistence in soil in the north-west European flora. *Journal of Ecology*, 86, 163-170. https://doi.org/10.1046/j.1365-2745.1998.00240.x

Van der Pijl, L. (1982) *Principles of dispersal*. Springer Verlag.

Van Roosmalen, M. (2013). *Wild fruit from the Amazon*.

Westoby, M., Leishman, M., & Lord, J. (1996) Comparative ecology of seed size and dispersal. *Philosophical Transactions of the Royal Society of London B*, 351, 1309–1318. https://www.doi.org/10.1098/RSTB.1996.0114

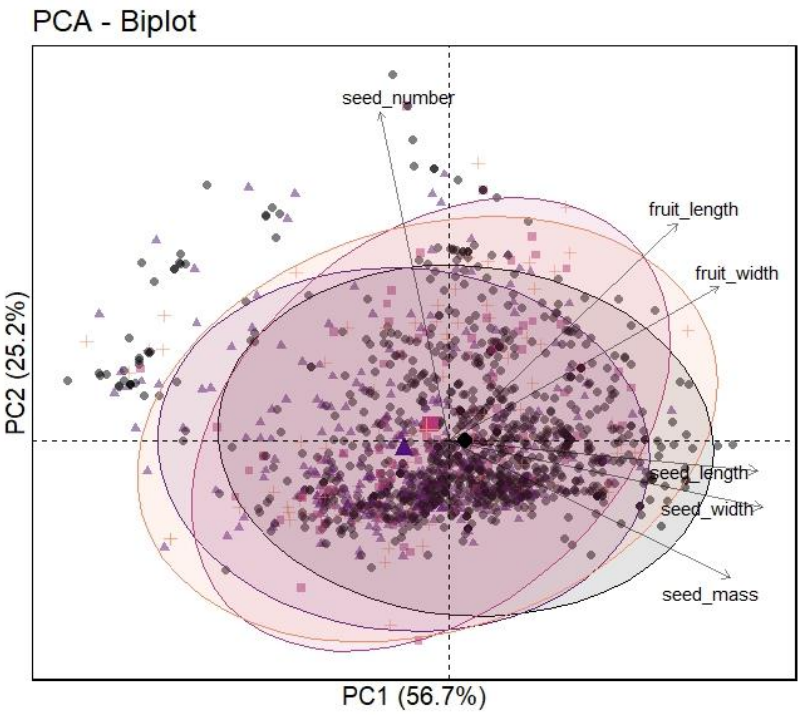
Westoby, M. (1998) A leaf-height-seed (LHS) plant ecology strategy scheme. *Plant and Soil*, 199, 213–227. https://doi.org/10.1023/A%3A1004327224729

Wright, I.J., Reich, P.B., Westoby, M., Ackerly, D.D., Baruch, Z., Bongers, F., Cavender-Bares, J. et.al. (2004) The worldwide leaf economics spectrum. *Nature*, 428, 821–7. https://doi.org/10.1038/nature02403

Wright, I.J., Ackerly, D.D., Bongers, F., Harms, K.E., Ibarra-Manriquez, G., Martinez-Ramos, M., Mazer, S.J. et al. (2007) Relationships among ecologically important dimensions of plant trait variation in seven Neotropical forests. *Annal of Botany*, 99,1003–1015. https://doi.org/10.1093/aob/mcl066

Supplementary material

APPENDIX I



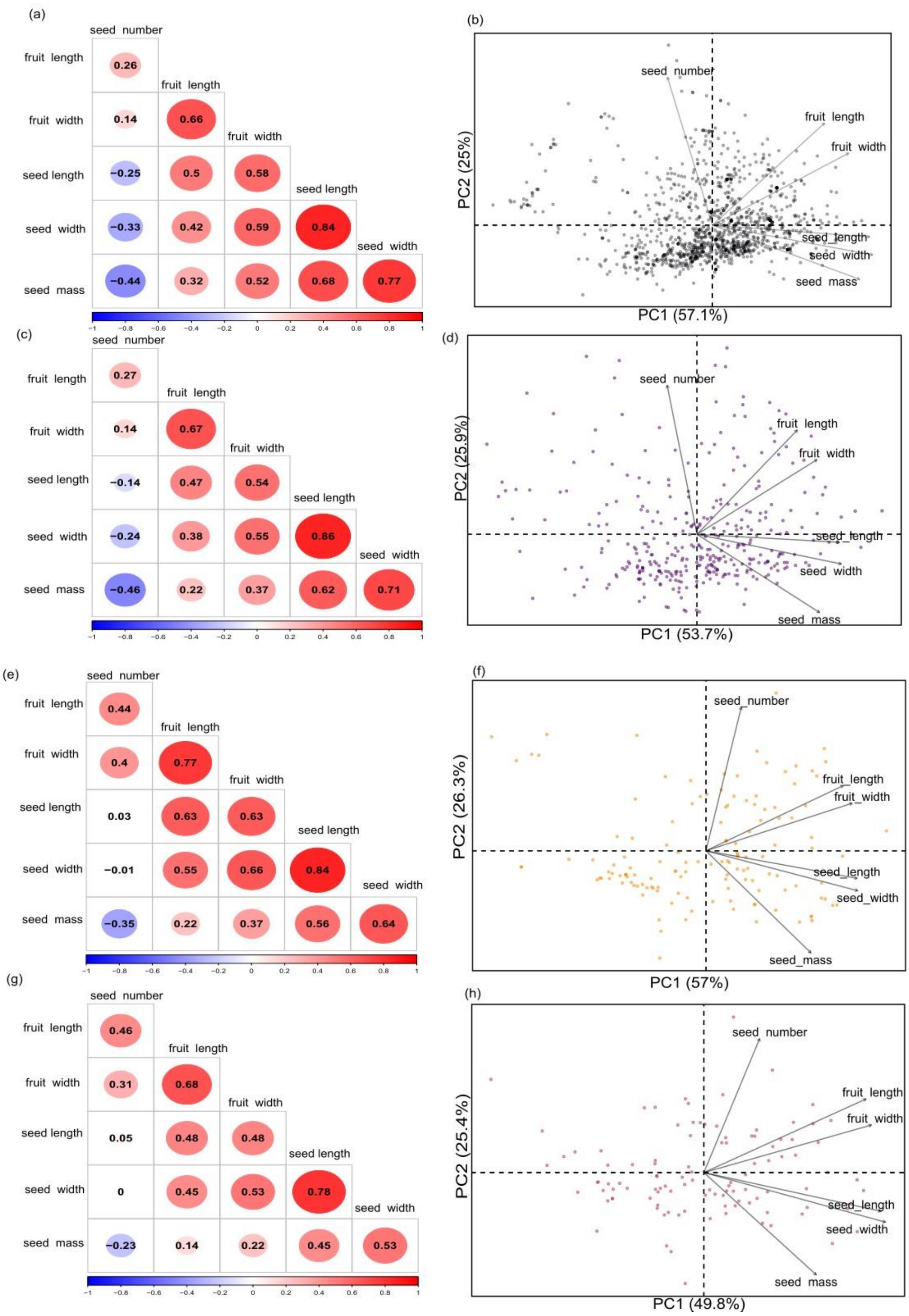
Appendix S1: Main trends for seed and fruit trait relationships, without considering 149 species that are common to two or more biomes. PCAs are represented by the first two components. Each symbol represents one species or morphospecies. Circles represent Amazon species, rectangles represent Caatinga species, triangles represent Atlantic Forest species, and crosses represent Cerrado species. The colours of the ellipses indicate different biomes: Amazon (black), Atlantic Forest (purple), Cerrado (orange), Caatinga (pink). The ellipses correspond to 0.95 quantiles.

Appendix S2: Number of species compiled and collected for each fruit and seed trait by source type.

Sources	Seed length	Seed width	Seed number	Fruit length	Fruit width	Seed mass
Literature	731	717	948	636	705	552
Online databases	25	14	1	16	17	268
Online herbarium	84	43	0	545	234	0
Personal comunications	138	120	0	44	21	357
REFLORA	96	88	138	188	155	4
Total	1074	982	1087	1429	1132	1181

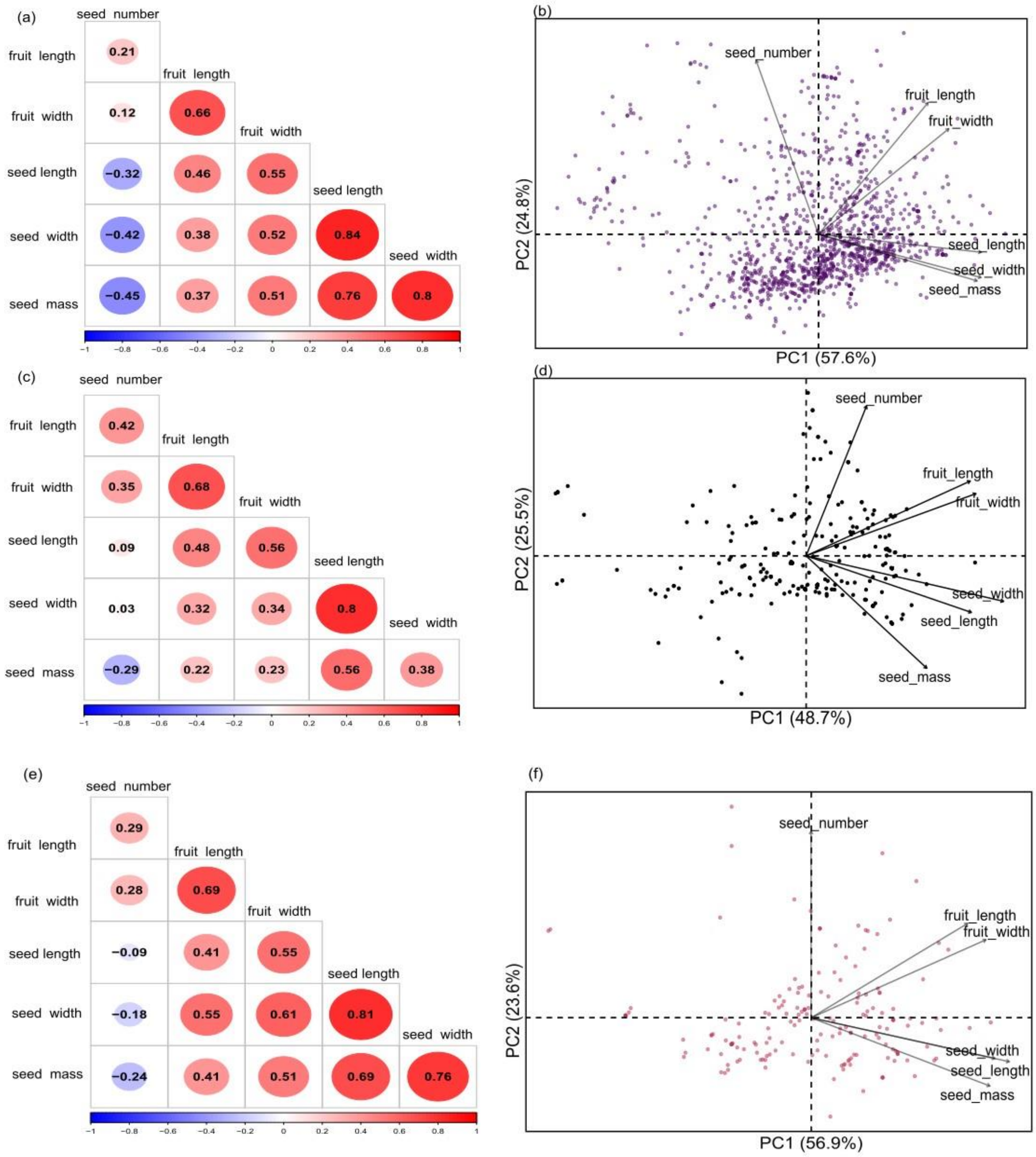
Appendix S3: Principal component analyses (PCAs) of seed and fruit traits. The proportion of variation explained and the eigenvalue of six traits along the PC1 and PC2 axes. Main trend corresponds to the PCA performed with all species/morphospecies (1658). The other PCAs correspond to trait variation for species/morphospecies from each biome – Amazon (n=1219), Atlantic Forest (n=347), Cerrado (n=136), and Caatinga (n=105) and dispersal modes – endozoochorous (n=1232), synzoochorous (n=175), and anemochorous (n=251).

	Main trend		Amazon		Atlantic Forest		Cerrado		Caatinga		Endozoochory		Synzoochory		Anemochory	
	PC1	PC2	PC1	PC2	PC1	PC2	PC1	PC2	PC1	PC2	PC1	PC2	PC1	PC2	PC1	PC2
Variation explained (%)	56.5	25.3	57.1	25	53.7	25.9	57.0	26.3	49.8	25.4	57.6	24.8	56.9	23.6	48.7	25.5
Eigenvalue	3.4	1.5	3.4	1.5	3.2	1.6	3.4	1.6	3.0	1.5	3.5	1.5	3.4	1.4	2.9	1.5
Seed mass	**0.80**	-0.39	**0.84**	-0.32	**0.77**	-0.45	**0.61**	**-0.64**	**0.52**	**-0.63**	**0.88**	-0.22	**0.82**	-0.33	**0.55**	**-0.62**
Seed width	**0.91**	-0.18	**0.91**	-0.17	**0.90**	-0.17	**0.89**	-0.25	**0.85**	-0.30	**0.90**	-0.21	**0.84**	-0.20	**0.90**	-0.25
Seed length	**0.89**	-0.07	**0.89**	-0.07	**0.89**	-0.04	**0.89**	-0.17	**0.83**	-0.23	**0.90**	-0.08	**0.91**	-0.21	**0.75**	-0.31
Fruit width	**0.79**	0.40	**0.77**	0.43	**0.75**	0.43	**0.86**	0.29	**0.78**	0.29	**0.72**	0.51	**0.80**	0.38	**0.77**	0.34
Fruit length	**0.67**	**0.58**	**0.63**	**0.61**	**0.63**	**0.60**	**0.80**	0.41	**0.76**	0.45	**0.61**	**0.64**	**0.72**	0.46	**0.74**	0.41
Seed number	-0.17	**0.90**	-0.25	**0.89**	-0.18	**0.86**	0.20	**0.90**	0.26	**0.82**	-0.34	**0.84**	0.00	**0.92**	0.27	**0.83**



Appendix S4: Relationships between seed and fruit traits for Amazon (a-b; n=1219), Atlantic Forest (c-d; n=347), Cerrado (e-f; n=136) and Caatinga species (g-h; n=105). **(a), (c), (e), (g):** Pearson correlation coefficients indicating positive correlations with red colour and negative correlations with blue colour. Non-significant correlation at $p<0.05$ are shown white colour. **(b),**

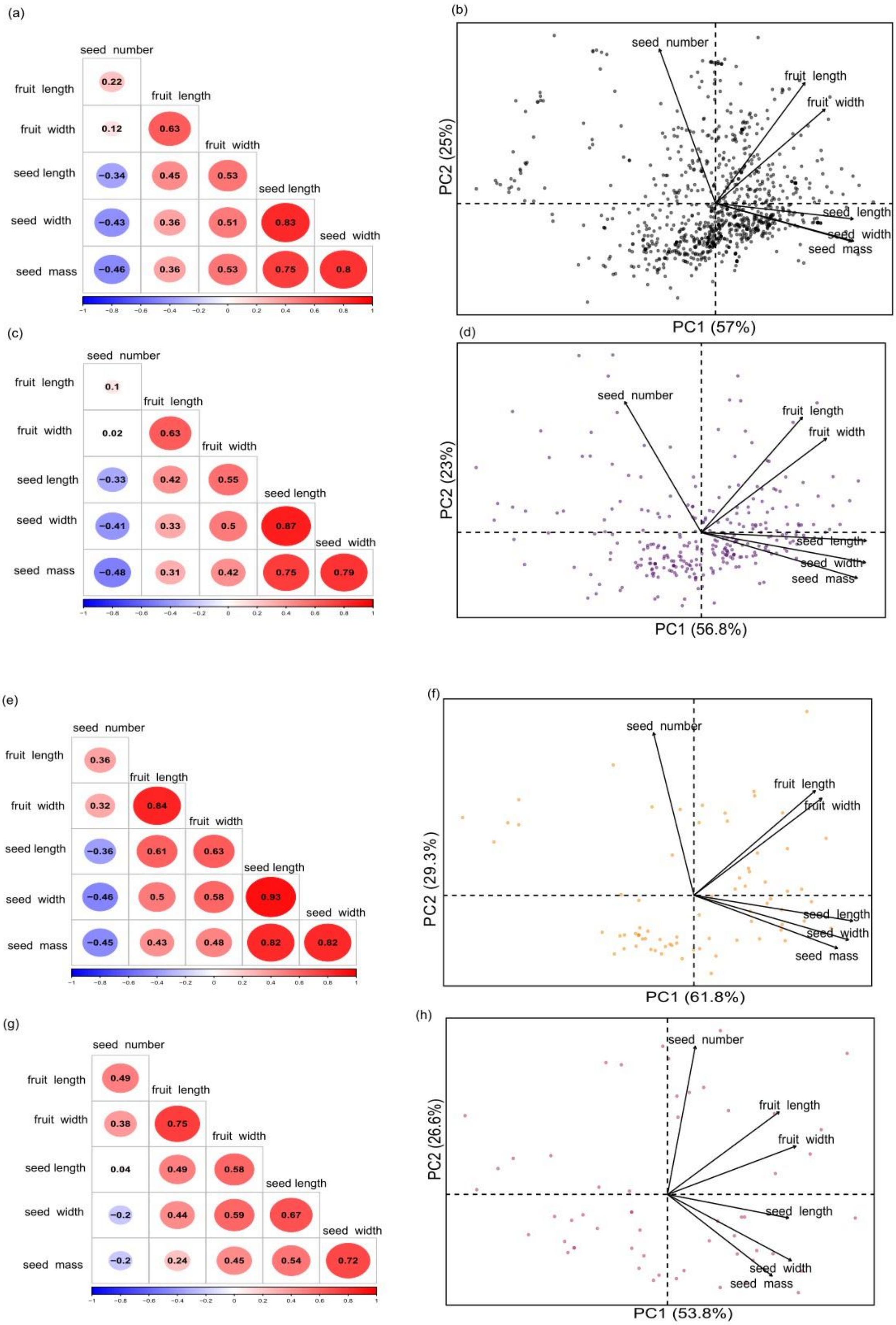
(d), (f), (h): PCAs are represented by the first two components. The dots represent each species/morphospecies from Amazon (black), Atlantic Forest (purple), Cerrado (orange) and Caatinga (pink).



Appendix S5: Relationships between seed and fruit traits for endozoochorous (a-b; n=1232), anemochorous species (e-f; n=251) and synzoochorous (c-d; n=175). (**a), (c), (e):** Pearson correlation coefficients indicating positive correlations with red colour and negative correlations with blue colour. Non-significant correlation at p<0.05 are shown with blank colour. (**b), (d), (f)**: PCAs are represented by the first two components. The dots represent each endozoochorous (purple), anemochorous (black) and synzoochorous (pink) species/morphospecies.

Appendix S6: Principal component analyses (PCAs) of seed and fruit traits for endozoochorous species from Amazon (n=919), Atlantic Forest (n=285), Cerrado (n=74) and Caatinga (n=55). The proportion of variation explained and the eigenvalue of six traits along the PC1 and PC2 axes.

ENDO	Amazon		Atlantic Forest		Cerrado		Caatinga	
	PC1	PC2	PC1	PC2	PC1	PC2	PC1	PC2
Variation explained (%)	57	25	56.8	23	61.8	29.3	53.8	26.6
Eigenvalue	3.4	1.5	3.4	1.4	3.7	1.8	3.2	1.6
Seed mass	**0.88**	-0.20	**0.86**	-0.26	**0.86**	-0.30	**0.71**	-0.49
Seed width	**0.90**	-0.20	**0.91**	-0.17	**0.93**	-0.25	**0.83**	-0.40
Seed length	**0.90**	-0.08	**0.91**	-0.04	**0.95**	-0.14	**0.81**	-0.14
Fruit width	**0.71**	0.51	**0.69**	0.53	**0.77**	0.56	**0.86**	0.29
Fruit lenght	**0.58**	**0.65**	**0.56**	**0.65**	**0.73**	0.60	**0.75**	0.50
Seed number	-0.36	**0.84**	-0.42	**0.74**	-0.24	**0.94**	0.18	**0.90**



Appendix S7: Relationships between seed and fruit traits for endozoochorous species from Amazon (a-b; n=919), Atlantic Forest (c-d; n=285), Cerrado (d-e; n=74) and Caatinga (f-g;

n=55). (**a), (c), (e), (g):** Pearson correlation coefficients indicating positive correlations with red colour and negative correlations with blue colour. Non-significant correlation at $p<0.05$ are shown with white colour. (**b), (d), (f), (h):** PCAs are represented by the first two components. The dots represent each endozoochorous species/morphospecies from Amazon (black), Atlantic Forest (purple), Cerrado (orange), and Caatinga (pink).

Appendix S8: Principal component analyses (PCAs) of seed and fruit traits for anemochorous species from Amazon (n=137), Atlantic Forest (n=52), Cerrado (n=55) and Caatinga (n=47). The proportion of variation explained and the eigenvalue of six traits along the PC1 and PC2 axes.

ANEMO	Amazon		Atlantic Forest		Cerrado		Caatinga	
	PC1	PC2	PC1	PC2	PC1	PC2	PC1	PC2
Variation explained (%)	49.1	26.0	49.4	22.2	56.1	19.7	45.0	26.1
Eigenvalue	2.9	1.6	3.0	1.3	3.4	1.2	2.7	1.6
Seed mass	**0.77**	-0.40	0.31	**0.83**	0.25	**0.90**	0.22	**0.74**
Seed width	**0.93**	-0.17	**0.89**	0.20	**0.87**	0.28	**0.86**	0.39
Seed length	**0.77**	-0.29	**0.73**	0.14	**0.82**	0.13	**0.76**	0.45
Fruit width	**0.69**	0.48	**0.79**	-0.01	**0.86**	-0.11	**0.72**	-0.34
Fruit lenght	**0.65**	**0.52**	**0.81**	-0.18	**0.82**	-0.20	**0.77**	-0.40
Seed number	0.01	**0.89**	0.52	**-0.74**	**0.67**	**-0.48**	0.47	**-0.62**

APPENDIX II

Table 1: Morphological seed and fruit traits based on 1,658 species and morphospecies from Amazon, Atlantic Forest, Cerrado and Caatinga

Specie	Family	Biome	Dispersal mode	Seed width	Seed length	Fruit width	Fruit length	Seed masss	Seed number
Abarema adenófora	Fabaceae	Amazon	ENDO	5.00	6.00	5.50	98.81	25.00	7.00
Abarema cochleata	Fabaceae	Amazon	ENDO	8.81	7.00	5.50	98.81	436.87	11.00
Abarema floribunda	Fabaceae	Amazon	ENDO	6.63	7.00	5.50	98.81	49.52	15.00
Abarema jupunba	Fabaceae	Amazon	ENDO	5.00	7.00	5.55	6.00	70.00	11.00
Abarema laeta	Fabaceae	Amazon	ENDO	7.50	10.00	5.50	99.86	49.52	14.00
Abarema langsdorffii	Fabaceae	Atlantic forest	ENDO	5.50	6.50	5.50	6.40	49.52	8.00
Abarema mataybifolia	Fabaceae	Amazon	ENDO	9.00	10.50	5.50	98.81	49.52	10.50
Abarema piresii	Fabaceae	Amazon	ENDO	8.00	16.33	5.50	98.81	49.52	10.00
Abarema sp	Fabaceae	Amazon	ENDO	5.50	7.00	5.50	98.81	49.52	11.00
Acioa longipendula	Chrysobalaceae	Amazon	ENDO	27.55	52.00	40.00	50.00	15411.35	1.00
Acosmium lentiscifolium	Fabaceae	Caatinga	ANEMO	6.90	17.70	19.16	36.79	45.46	13.00
Agonandra brasiliensis	Opiliaceae	Cerrado	ENDO	15.80	15.80	21.50	27.00	1670.00	1.00
Agonandra excelsa	Opiliaceae	Atlantic forest	ENDO	12.00	15.00	21.00	22.50	1670.00	1.00
Agonandra silvatica	Opiliaceae	Amazon	ENDO	11.00	13.00	20.00	22.89	1670.00	1.00
Agonandra sp	Opiliaceae	Amazon	ENDO	13.50	14.00	21.00	23.50	1670.00	1.00
Aiouea glaziovii	Lauraceae	Atlantic forest	ENDO	9.00	18.00	13.35	15.36	161.29	1.00
Aiouea grandifolia	Lauraceae	Amazon	ENDO	9.00	16.00	12.95	14.32	161.29	1.00
Aiouea guianensis	Lauraceae	Amazon	ENDO	9.00	16.00	7.00	14.32	161.29	1.00
Aiouea myristicoides	Lauraceae	Amazon	ENDO	9.00	16.00	12.95	14.32	161.29	1.00

Aiouea saligna	Lauraceae	Amazon	ENDO	9.00	16.00	10.00	17.00	161.29	1.00
Aiouea sp	Lauraceae	Amazon	ENDO	9.00	16.00	12.95	14.32	161.29	1.00
Aiouea tomentella	Lauraceae	Amazon	ENDO	9.00	16.00	12.95	14.32	161.29	1.00
Aiouea trinervis	Lauraceae	Amazon	ENDO	9.00	16.00	12.95	11.14	161.29	1.00
Albizia duckeana	Fabaceae	Amazon	ENDO	4.00	7.00	9.20	90.00	28.50	15.00
Albizia pedicellaris	Fabaceae	Amazon	ENDO	3.50	8.25	3.90	49.30	28.50	15.00
Albizia polycephala	Fabaceae	Atlantic forest	ENDO	6.41	8.46	14.50	130.13	28.50	15.00
Alchornea discolor	Euphorbiaceae	Amazon	ENDO	4.00	8.00	6.00	51.50	66.67	3.00
Alchornea glandulosa	Euphorbiaceae	Atlantic forest	ENDO	5.00	8.00	6.59	9.49	80.00	2.00
Alchornea triplinervia	Euphorbiaceae	Cerrado	ENDO	4.10	5.80	4.70	5.80	100.00	2.00
Aldina heterophylla	Fabaceae	Amazon	SINZO	30.00	30.00	26.50	22.50	13330.00	1.00
Allantoma decandra	Lecythidaceae	Amazon	ANEMO	8.43	22.91	1.31	2.00	227.71	36.50
Allantoma integrifolia	Lecythidaceae	Amazon	ANEMO	8.43	22.91	25.00	135.00	227.71	36.50
Allantoma lineata	Lecythidaceae	Amazon	SINZO	11.00	55.00	52.50	175.00	4550.00	36.50
Allantoma pauciramosa	Lecythidaceae	Amazon	ANEMO	8.43	22.91	30.00	80.00	227.71	36.50
Allophylus amazonicus	Sapindaceae	Amazon	ENDO	7.47	10.78	5.50	10.39	95.82	1.00
Allophylus glabratus	Sapindaceae	Amazon	ENDO	7.47	10.78	5.50	10.39	155.83	1.00
Allophylus latifolius	Sapindaceae	Amazon	ENDO	7.47	10.78	5.50	10.39	119.33	1.00
Allophylus sp	Sapindaceae	Amazon	ENDO	7.47	10.78	5.50	10.39	119.33	1.00
Alseis eggersii	Rubiaceae	Amazon	ANEMO	0.50	3.13	1.87	10.00	0.33	13.00
Alseis floribunda	Rubiaceae	Atlantic forest	ANEMO	0.50	3.13	1.81	9.34	0.33	13.00
Alseis peruviana	Rubiaceae	Amazon	ANEMO	0.50	3.13	1.87	10.00	0.33	13.00
Alseis pickelii	Rubiaceae	Caatinga	ANEMO	0.50	3.13	2.00	15.00	0.33	13.00
Alseis sp	Rubiaceae	Amazon	ANEMO	0.50	3.13	1.87	10.00	0.33	13.00
Amaioua glomerulata	Rubiaceae	Amazon	ENDO	3.50	4.05	9.63	17.00	9.70	17.00
Amaioua guianensis	Rubiaceae	Atlantic forest	ENDO	2.74	4.25	9.82	17.00	8.00	17.00
Amaioua intermedia	Rubiaceae	Atlantic forest	ENDO	3.61	4.60	9.24	19.38	10.50	17.00

Amaioua sp	Rubiaceae	Amazon	ENDO	3.50	4.05	9.63	17.00	9.70	17.00
Ambelania acida	Apocyaceae	Amazon	ENDO	6.00	8.00	27.39	56.57	29.64	84.00
Amburana acreana	Fabaceae	Amazon	ANEMO	8.00	13.00	14.57	70.52	269.30	1.00
Amburana cearensis	Fabaceae	Caatinga	ANEMO	14.83	17.90	14.57	70.52	269.30	1.00
Amburana sp	Fabaceae	Amazon	ANEMO	12.90	15.45	14.57	70.52	269.30	1.00
Anacardium giganteum	Anacardiaceae	Amazon	ENDO	20.00	24.00	18.00	39.50	2050.00	1.00
Anacardium occidentale	Anacardiaceae	Cerrado	ENDO	15.00	22.00	25.00	35.00	4086.50	1.00
Anacardium parvifolium	Anacardiaceae	Amazon	ENDO	20.00	24.00	24.88	39.50	2290.00	1.00
Anacardium spruceanum	Anacardiaceae	Amazon	ENDO	8.00	21.50	24.88	44.00	2080.00	1.00
Anadenanthera colubrina	Fabaceae	Caatinga	ANEMO	10.63	12.00	12.87	201.65	146.10	1.00
Anadenanthera peregrina	Fabaceae	Caatinga	ENDO	15.49	19.04	28.00	176.90	87.79	12.00
Anadenanthera sp	Fabaceae	Cerrado	ANEMO	10.63	12.00	12.87	201.65	2.00	10.00
Anaxagorea acuminata	Annonaceae	Amazon	ENDO	7.50	13.00	13.27	32.96	298.00	45.00
Anaxagorea brevipes	Annonaceae	Amazon	ENDO	6.00	6.00	13.27	32.96	298.00	45.00
Anaxagorea dolichocarpa	Annonaceae	Atlantic forest	ENDO	9.68	15.25	13.27	32.96	298.00	45.00
Anaxagorea manausensis	Annonaceae	Amazon	ENDO	7.00	7.00	13.27	32.96	298.00	45.00
Anaxagorea prinoides	Annonaceae	Amazon	ENDO	6.50	6.50	13.27	32.96	298.00	45.00
Andira cujabensis	Fabaceae	Cerrado	SINZO	34.31	40.45	30.00	34.00	2860.00	1.00
Andira fraxinifolia	Fabaceae	Atlantic forest	SINZO	34.31	40.90	30.00	42.50	2030.30	2.00
Andira micrantha	Fabaceae	Amazon	SINZO	34.31	40.45	30.00	95.00	2830.00	1.00
Andira multistipula	Fabaceae	Amazon	SINZO	34.31	40.45	30.00	30.00	2830.00	1.00
Andira parviflora	Fabaceae	Amazon	SINZO	34.31	40.45	30.00	37.75	2830.00	1.00
Andira sp	Fabaceae	Cerrado	SINZO	34.31	40.45	30.00	35.25	2830.00	1.00
Andira surinamensis	Fabaceae	Amazon	SINZO	34.31	40.45	40.00	45.00	2800.00	1.50
Andira trifoliolata	Fabaceae	Amazon	SINZO	34.31	40.45	30.00	29.00	2830.00	1.00
Andira unifoliolata	Fabaceae	Amazon	SINZO	34.31	40.45	25.00	33.00	2830.00	1.00
Andira vermifuga	Fabaceae	Cerrado	SINZO	34.31	40.00	30.00	32.00	4000.00	1.00

Aniba burchellii	Lauraceae	Amazon	ENDO	10.50	15.00	15.00	24.50	770.00	1.00
Aniba canelilla	Lauraceae	Amazon	ENDO	14.40	19.30	16.00	24.50	691.20	1.00
Aniba ferrea	Lauraceae	Amazon	ENDO	13.00	19.30	15.00	24.50	770.00	1.00
Aniba firmula	Lauraceae	Atlantic forest	ENDO	15.40	23.00	20.00	25.00	691.20	1.00
Aniba guianensis	Lauraceae	Amazon	ENDO	13.00	19.30	20.00	24.50	770.00	1.00
Aniba jenmanii	Lauraceae	Amazon	ENDO	13.00	19.30	10.00	12.00	770.00	1.00
Aniba megaphylla	Lauraceae	Amazon	ENDO	13.00	19.30	10.00	24.89	770.00	1.00
Aniba panurensis	Lauraceae	Amazon	ENDO	13.00	19.30	15.00	34.10	770.00	1.00
Aniba parviflora	Lauraceae	Amazon	ENDO	13.00	19.30	15.00	24.50	2872.22	1.00
Aniba rosaeodora	Lauraceae	Amazon	ENDO	13.00	19.30	15.00	32.81	1983.28	1.00
Aniba santalodora	Lauraceae	Amazon	ENDO	13.00	19.30	15.00	24.50	770.00	1.00
Aniba sp	Lauraceae	Amazon	ENDO	13.00	19.30	15.00	24.50	770.00	1.00
Aniba terminalis	Lauraceae	Amazon	ENDO	13.00	19.30	13.99	5.00	770.00	1.00
Aniba viridis	Lauraceae	Atlantic forest	ENDO	13.00	22.50	14.90	25.00	770.00	1.00
Aniba williamsii	Lauraceae	Amazon	ENDO	13.00	19.30	15.00	24.50	770.00	1.00
Annona amazonica	Annonaceae	Amazon	ENDO	7.24	7.25	32.50	34.09	172.20	130.00
Annona ambotay	Annonaceae	Amazon	ENDO	9.00	15.00	36.73	24.29	152.00	130.00
Annona crassiflora	Annonaceae	Cerrado	ENDO	8.74	18.02	133.33	142.50	666.00	130.00
Annona cuspidata	Annonaceae	Amazon	ENDO	7.50	12.50	36.73	17.83	152.00	130.00
Annona densicoma	Annonaceae	Amazon	ENDO	6.00	13.00	35.00	45.89	152.00	130.00
Annona dolabripetala	Annonaceae	Atlantic forest	ENDO	5.70	8.85	3.80	48.98	152.00	130.00
Annona excellens	Annonaceae	Amazon	ENDO	7.24	15.50	36.73	34.50	152.00	130.00
Annona exsucca	Annonaceae	Amazon	ENDO	4.50	3.50	42.50	8.00	152.00	130.00
Annona foetida	Annonaceae	Amazon	ENDO	7.00	12.00	45.00	62.50	149.00	130.00
Annona leptopetala	Annonaceae	Caatinga	ENDO	7.50	10.00	9.00	19.25	105.00	130.00
Annona neoinsignis	Annonaceae	Amazon	ENDO	7.24	7.50	36.73	23.60	152.00	130.00
Annona salzmannii	Annonaceae	Amazon	ENDO	8.00	21.50	88.60	87.00	152.00	130.00

Annona sp	Annonaceae	Atlantic forest	ENDO	7.24	12.25	36.73	34.50	152.00	130.00
Annona spinescens	Annonaceae	Caatinga	ENDO	4.00	7.25	37.50	41.48	152.00	130.00
Annona sylvatica	Annonaceae	Atlantic forest	ENDO	7.80	17.10	37.20	34.70	152.00	130.00
Annona vepretorum	Annonaceae	Caatinga	ENDO	12.00	22.00	70.00	75.00	152.00	130.00
Aparisthmium cordatum	Euphorbiaceae	Amazon	ENDO	4.00	10.00	9.89	8.64	50.00	3.00
Aptandra sp	Olacaceae	Amazon	ENDO	22.50	22.00	22.25	50.00	5322.00	1.00
Aptandra tubicina	Olacaceae	Amazon	ENDO	22.50	22.00	22.25	50.00	5322.00	1.00
Apuleia leiocarpa	Fabaceae	Atlantic forest	ANEMO	6.21	7.09	20.06	53.85	73.00	2.50
Aspidosperma album	Apocyaceae	Amazon	ANEMO	26.56	37.80	22.50	33.40	350.00	9.00
Aspidosperma araracanga	Apocyaceae	Amazon	ANEMO	26.56	37.80	40.00	72.46	227.55	9.00
Aspidosperma auriculatum	Apocyaceae	Amazon	ANEMO	26.56	37.80	40.00	72.46	227.55	9.00
Aspidosperma australe	Apocyaceae	Atlantic forest	ANEMO	25.00	38.00	40.00	61.00	140.81	9.00
Aspidosperma carapanauba	Apocyaceae	Amazon	ANEMO	26.56	37.80	40.00	72.46	227.55	9.00
Aspidosperma cylindrocarpon	Apocyaceae	Cerrado	ANEMO	15.10	42.84	20.47	84.68	181.00	20.00
Aspidosperma desmanthum	Apocyaceae	Amazon	ANEMO	26.56	37.80	25.00	47.00	760.00	9.00
Aspidosperma discolor	Apocyaceae	Amazon	ANEMO	40.00	44.00	39.99	48.00	166.67	9.00
Aspidosperma eteanum	Apocyaceae	Amazon	ANEMO	26.56	37.80	40.00	72.46	227.55	9.00
Aspidosperma excelsum	Apocyaceae	Amazon	ANEMO	25.00	34.50	40.00	72.46	165.00	9.00
Aspidosperma macrocarpon	Apocyaceae	Cerrado	ANEMO	72.09	74.02	88.80	194.76	227.55	9.00
Aspidosperma marcgravianum	Apocyaceae	Amazon	ANEMO	26.56	37.80	40.00	72.46	227.55	9.00
Aspidosperma multiflorum	Apocyaceae	Cerrado	ANEMO	26.56	36.64	40.00	72.46	227.55	9.00
Aspidosperma myristicifolium	Apocyaceae	Amazon	ANEMO	26.56	37.80	40.00	72.46	227.55	9.00
Aspidosperma nitidum	Apocyaceae	Amazon	ANEMO	26.56	37.80	26.50	39.50	227.55	9.00
Aspidosperma olivaceum	Apocyaceae	Atlantic forest	ANEMO	24.80	37.60	24.76	54.55	227.55	9.00
Aspidosperma parvifolium	Apocyaceae	Atlantic forest	ANEMO	29.53	47.30	33.16	72.46	200.00	7.00
Aspidosperma pyrifolium	Apocyaceae	Caatinga	ANEMO	44.16	49.13	57.97	66.60	229.42	7.91
Aspidosperma rigidum	Apocyaceae	Amazon	ANEMO	26.56	37.80	40.00	72.46	227.55	9.00

Aspidosperma sandwithianum	Apocyaceae	Amazon	ANEMO	26.56	37.80	40.00	72.46	227.55	9.00
Aspidosperma schultesii	Apocyaceae	Amazon	ANEMO	26.56	37.80	40.00	72.46	227.55	9.00
Aspidosperma sp	Apocyaceae	Caatinga	ANEMO	26.56	37.80	40.00	72.46	227.55	9.00
Aspidosperma spruceanum	Apocyaceae	Atlantic forest	ANEMO	21.00	22.00	57.79	72.29	115.00	10.00
Aspidosperma tomentosum	Apocyaceae	Caatinga	ANEMO	64.04	42.00	47.31	81.57	350.94	6.00
Aspidosperma vargasii	Apocyaceae	Amazon	ANEMO	26.56	37.80	40.00	72.46	227.55	9.00
Astrocaryum aculeatissimum	Arecaceae	Atlantic forest	SINZO	27.90	42.70	45.00	60.00	10381.37	1.00
Astrocaryum aculeatum	Arecaceae	Amazon	SINZO	43.00	36.50	42.50	57.50	13540.00	1.00
Astrocaryum gynacanthum	Arecaceae	Amazon	SINZO	26.45	35.00	17.50	35.00	1535.00	1.00
Astrocaryum jauari	Arecaceae	Amazon	SINZO	18.00	24.50	23.75	38.75	9543.35	1.00
Astrocaryum murumuru	Arecaceae	Amazon	SINZO	25.00	40.00	41.00	72.50	8675.00	1.00
Astrocaryum sp	Arecaceae	Amazon	SINZO	26.45	35.00	32.50	45.00	9543.35	1.00
Astrocaryum vulgare	Arecaceae	Caatinga	SINZO	26.45	35.00	32.50	43.75	8310.00	1.00
Astronium fraxinifolium	Anacardiaceae	Cerrado	ANEMO	2.00	9.33	1.88	12.99	29.93	1.00
Astronium graveolens	Anacardiaceae	Amazon	ANEMO	2.27	12.17	1.88	13.50	27.00	1.00
Astronium lecointei	Anacardiaceae	Amazon	ANEMO	2.00	11.00	1.88	26.50	28.17	1.00
Astronium ulei	Anacardiaceae	Amazon	ANEMO	2.00	11.00	1.88	26.50	28.17	1.00
Astronium urundeuva	Anacardiaceae	Caatinga	ANEMO	2.00	11.00	1.88	20.00	28.17	1.00
Attalea butyracea	Arecaceae	Amazon	SINZO	30.00	35.00	42.25	68.25	10165.50	2.50
Attalea maripa	Arecaceae	Amazon	SINZO	18.10	40.74	25.75	54.75	588000.00	2.00
Attalea phalerata	Arecaceae	Amazon	SINZO	25.60	50.00	56.75	64.00	29410.00	2.50
Attalea sp	Arecaceae	Amazon	SINZO	27.80	45.37	46.00	64.00	43872.50	2.50
Attalea speciosa	Arecaceae	Amazon	SINZO	47.50	85.00	68.00	98.75	113341.86	3.00
Barnebydendron riedelii	Fabaceae	Amazon	ANEMO	2.41	1.80	15.00	45.00	625.00	1.50
Batesia floribunda	Fabaceae	Amazon	ENDO	7.00	9.00	32.50	35.00	240.00	2.50
Bertholletia excelsa	Lecythidaceae	Amazon	SINZO	20.50	43.50	66.00	37.50	6600.00	17.50
Blepharocalyx eggersii	Myrtaceae	Amazon	ENDO	3.47	0.60	6.31	8.89	33690.00	2.00

Blepharocalyx salicifolius	Myrtaceae	Cerrado	ENDO	3.47	4.67	6.31	6.66	33690.00	2.00
Bocageopsis canescens	Annonaceae	Amazon	ENDO	8.00	10.00	7.00	7.00	80.00	2.00
Bocageopsis multiflora	Annonaceae	Amazon	ENDO	7.00	7.00	7.00	7.00	200.00	2.50
Bocageopsis pleiosperma	Annonaceae	Amazon	ENDO	8.00	10.00	7.00	7.00	84.75	3.00
Bowdichia nitida	Fabaceae	Amazon	ANEMO	3.77	6.00	54.00	21.70	25.31	7.00
Bowdichia sp	Fabaceae	Amazon	ANEMO	3.77	6.00	31.00	34.50	25.31	7.00
Bowdichia virgilioides	Fabaceae	Cerrado	ANEMO	3.77	6.00	54.00	21.70	25.31	7.00
Brosimum acutifolium	Moraceae	Amazon	ENDO	8.81	11.00	19.00	12.97	900.00	2.00
Brosimum alicastrum	Moraceae	Amazon	ENDO	11.50	12.00	17.50	14.23	1066.00	2.00
Brosimum gaudichaudii	Moraceae	Cerrado	ENDO	15.30	19.00	23.67	26.00	1061.49	2.00
Brosimum glaziovii	Moraceae	Atlantic forest	ENDO	14.00	20.00	25.00	30.00	263.16	2.00
Brosimum guianense	Moraceae	Atlantic forest	ENDO	11.50	7.50	19.00	6.06	272.50	2.00
Brosimum lactescens	Moraceae	Atlantic forest	ENDO	7.63	15.00	22.30	32.00	1000.00	2.00
Brosimum longifolium	Moraceae	Amazon	ENDO	11.50	12.00	19.00	11.00	900.00	2.00
Brosimum melanopotamicum	Moraceae	Amazon	ENDO	11.50	12.00	19.00	7.11	900.00	2.00
Brosimum parinarioides	Moraceae	Amazon	ENDO	8.00	9.00	19.55	20.27	1929.97	2.00
Brosimum potabile	Moraceae	Amazon	ENDO	11.79	11.00	19.00	13.86	900.00	2.00
Brosimum rubescens	Moraceae	Amazon	ENDO	6.60	9.40	14.00	25.00	900.00	2.00
Brosimum sp	Moraceae	Amazon	ENDO	11.50	12.00	19.00	13.86	900.00	2.00
Brosimum utile	Moraceae	Amazon	ENDO	12.00	15.50	12.00	13.86	735.00	1.00
Brosimum utile subsp. ovatifolium	Moraceae	Amazon	ENDO	11.50	12.00	19.00	13.48	900.00	2.00
Byrsonima coccolobifolia	Malpighiaceae	Cerrado	ENDO	4.83	5.64	7.64	9.09	105.26	1.00
Byrsonima crispa	Malpighiaceae	Amazon	ENDO	5.55	6.50	1.60	12.00	158.53	1.00
Byrsonima densa	Malpighiaceae	Amazon	ENDO	5.55	6.50	5.50	13.34	158.53	1.00
Byrsonima duckeana	Malpighiaceae	Amazon	ENDO	5.55	6.50	14.50	10.09	257.32	1.00
Byrsonima incarnata	Malpighiaceae	Amazon	ENDO	5.55	6.50	11.75	11.00	158.53	1.00
Byrsonima laxiflora	Malpighiaceae	Atlantic forest	ENDO	4.68	5.04	9.25	8.67	158.53	1.00

Byrsonima pachyphylla	Malpighiaceae	Cerrado	ENDO	6.00	7.00	8.00	9.50	158.53	1.00
Byrsonima sp	Malpighiaceae	Cerrado	ENDO	5.55	6.50	9.29	10.09	158.53	1.00
Byrsonima spicata	Malpighiaceae	Amazon	ENDO	6.53	7.41	9.29	9.99	289.20	1.00
Byrsonima verbascifolia	Malpighiaceae	Cerrado	ENDO	7.80	8.80	16.14	18.26	151.00	3.00
Cabralea canjerana	Meliaceae	Atlantic forest	ENDO	9.00	10.00	25.00	28.00	840.00	7.00
Callisthene major	Vochysiaceae	Cerrado	ANEMO	5.40	9.00	10.17	13.83	588.24	4.50
Callisthene microphylla	Vochysiaceae	Caatinga	ANEMO	4.25	8.35	10.00	12.00	588.24	4.50
Callisthene minor	Vochysiaceae	Cerrado	ANEMO	3.10	7.70	6.75	8.38	588.24	4.00
Callisthene mollissima	Vochysiaceae	Cerrado	ANEMO	4.25	8.35	10.00	12.00	588.24	4.50
Calophyllum brasiliense	Calophyllaceae	Atlantic forest	ENDO	14.00	16.00	21.80	23.00	2341.00	1.00
Calophyllum sp	Calophyllaceae	Amazon	ENDO	14.00	16.00	21.80	23.00	2341.00	1.00
Calycophyllum spruceanum	Rubiaceae	Amazon	ANEMO	0.94	5.86	6.78	2.99	0.15	4.00
Calyptranthes brasiliensis	Myrtaceae	Atlantic forest	ENDO	2.73	3.05	5.80	7.80	95.24	1.50
Campomanesia aromatica	Myrtaceae	Amazon	ENDO	6.70	7.00	15.90	19.00	79.89	4.50
Campomanesia grandiflora	Myrtaceae	Amazon	ENDO	6.70	8.00	22.80	23.91	79.89	4.50
Campomanesia guaviroba	Myrtaceae	Atlantic forest	ENDO	8.60	8.50	27.00	27.00	111.15	4.50
Campomanesia guazumifolia	Myrtaceae	Atlantic forest	ENDO	6.00	10.00	22.80	2.30	48.63	4.50
Caraipa densifolia	Calophyllaceae	Amazon	ANEMO	10.00	14.60	16.25	25.49	50.00	1.50
Caraipa grandifolia	Calophyllaceae	Amazon	ANEMO	9.00	11.50	16.25	25.49	50.00	1.50
Caraipa heterocarpa	Calophyllaceae	Amazon	ANEMO	9.00	11.50	16.25	25.49	50.00	1.50
Caraipa odorata	Calophyllaceae	Amazon	ANEMO	9.00	11.50	16.25	25.49	50.00	1.50
Caraipa punctulata	Calophyllaceae	Amazon	ANEMO	9.00	11.00	16.25	25.49	35.00	1.50
Caraipa rodriguesii	Calophyllaceae	Amazon	ANEMO	9.00	11.50	16.25	25.49	100.00	1.50
Caraipa sp	Calophyllaceae	Amazon	ANEMO	9.00	11.50	16.25	25.49	50.00	1.50
Carapa guianensis	Meliaceae	Amazon	SINZO	50.00	46.00	86.00	85.00	16710.00	10.00
Carapa procera	Meliaceae	Amazon	SINZO	50.00	40.00	78.00	78.00	19200.00	12.50
Carapa vasquezii	Meliaceae	Amazon	SINZO	50.00	21.20	49.49	48.14	3291.72	11.25

Cariniana estrellensis	Lecythidaceae	Atlantic forest	ANEMO	10.68	30.22	29.16	78.22	85.00	27.50
Cariniana legalis	Lecythidaceae	Amazon	ANEMO	8.57	26.66	23.56	62.15	30.13	12.50
Cariniana micrantha	Lecythidaceae	Amazon	ANEMO	9.44	28.66	24.50	64.96	170.00	20.00
Cariniana sp	Lecythidaceae	Atlantic forest	ANEMO	9.44	28.66	24.50	64.96	58.13	20.00
Carpotroche brasiliensis	Anacardiaceae	Atlantic forest	ENDO	11.70	22.30	84.80	93.70	600.00	22.00
Carpotroche crispidentata	Anacardiaceae	Amazon	ENDO	11.70	15.00	84.80	58.64	600.00	22.00
Caryocar brasiliense	Caryocaraceae	Cerrado	SINZO	23.97	34.30	50.00	55.00	6448.94	2.00
Caryocar coriaceum	Caryocaraceae	Cerrado	SINZO	35.60	38.50	54.29	55.00	5260.00	1.50
Caryocar cuneatum	Caryocaraceae	Cerrado	SINZO	27.50	38.50	54.29	55.00	6900.00	1.50
Caryocar glabrum	Caryocaraceae	Amazon	SINZO	25.00	34.00	58.00	43.00	6900.00	4.00
Caryocar pallidum	Caryocaraceae	Amazon	SINZO	27.50	38.50	54.29	55.00	6900.00	4.00
Caryocar sp	Caryocaraceae	Amazon	SINZO	27.50	38.50	54.29	55.00	6900.00	4.00
Caryocar villosum	Caryocaraceae	Amazon	SINZO	27.50	60.00	75.00	65.00	15504.79	1.75
Casearia arborea	Salicaceae	Atlantic forest	ENDO	1.50	1.75	3.50	7.00	1.61	6.00
Casearia combaymensis	Salicaceae	Amazon	ENDO	2.50	4.20	4.19	6.86	13.45	5.50
Casearia commersoniana	Salicaceae	Caatinga	ENDO	5.30	5.97	6.05	4.50	139.11	5.50
Casearia decandra	Salicaceae	Atlantic forest	ENDO	6.00	4.79	5.80	8.60	125.00	3.00
Casearia duckeana	Salicaceae	Amazon	ENDO	2.50	4.20	4.19	14.62	13.45	5.50
Casearia grandiflora	Salicaceae	Caatinga	ENDO	1.52	2.25	4.00	6.75	11.91	10.00
Casearia guianensis	Salicaceae	Amazon	ENDO	2.50	3.00	3.67	6.86	3.64	5.50
Casearia javitensis	Salicaceae	Amazon	ENDO	6.50	4.00	6.19	7.64	22.50	5.50
Casearia lasiophylla	Salicaceae	Atlantic forest	ENDO	4.50	5.40	11.00	11.70	47.50	5.50
Casearia mariquitensis	Salicaceae	Amazon	ENDO	2.50	5.00	4.70	5.00	13.45	7.00
Casearia obliqua	Salicaceae	Atlantic forest	ENDO	1.00	1.50	3.50	4.00	380.00	5.50
Casearia paranaensis	Salicaceae	Atlantic forest	ENDO	2.50	4.20	4.19	6.86	13.45	3.50
Casearia pitumba	Salicaceae	Amazon	ENDO	5.00	11.00	4.19	16.96	13.45	5.50
Casearia resinifera	Salicaceae	Amazon	ENDO	2.50	13.25	27.50	6.86	13.45	5.50

Casearia selloana	Salicaceae	Caatinga	ENDO	2.50	4.00	3.50	5.00	13.45	5.50
Casearia sp	Salicaceae	Caatinga	ENDO	2.50	4.20	4.19	6.86	13.45	5.50
Casearia sylvestris	Salicaceae	Atlantic forest	ENDO	1.65	12.65	5.00	5.75	3.00	6.50
Casearia ulmifolia	Salicaceae	Caatinga	ENDO	2.50	2.88	3.50	4.00	13.45	2.75
Cecropia concolor	Urticaceae	Amazon	ENDO	1.30	2.75	12.62	150.00	0.33	50.00
Cecropia distachya	Urticaceae	Amazon	ENDO	1.60	3.90	2.00	77.50	3.00	50.00
Cecropia ficifolia	Urticaceae	Amazon	ENDO	1.30	2.75	12.62	85.00	1.26	50.00
Cecropia glaziovii	Urticaceae	Atlantic forest	ENDO	0.62	2.00	12.62	230.00	0.50	50.00
Cecropia hololeuca	Urticaceae	Atlantic forest	ENDO	0.98	2.60	20.58	190.00	1.11	50.00
Cecropia obtusa	Urticaceae	Amazon	ENDO	0.50	1.60	12.62	150.00	0.12	50.00
Cecropia palmata	Urticaceae	Amazon	ENDO	1.20	1.60	12.62	150.00	1.19	50.00
Cecropia purpurascens	Urticaceae	Amazon	ENDO	1.30	2.75	12.62	150.00	0.62	50.00
Cecropia sciadophylla	Urticaceae	Amazon	ENDO	0.90	1.90	12.62	150.00	1.70	50.00
Cecropia sp	Urticaceae	Atlantic forest	ENDO	1.30	2.75	12.62	150.00	1.19	50.00
Cedrela fissilis	Meliaceae	Atlantic forest	ANEMO	11.86	37.30	38.00	78.00	37.00	65.00
Cedrela odorata	Meliaceae	Amazon	ANEMO	8.63	24.40	24.42	37.27	14.23	35.00
Cedrela sp	Meliaceae	Amazon	ANEMO	9.96	30.60	30.96	67.50	14.36	50.00
Cedrelinga cateniformis	Fabaceae	Amazon	SINZO	10.38	22.62	45.00	169.33	462.08	6.00
Ceiba insignis	Malvaceae	Amazon	ANEMO	6.45	8.11	80.00	150.00	60.00	131.75
Ceiba pentandra	Malvaceae	Amazon	ANEMO	4.75	5.58	80.00	150.00	57.50	147.50
Ceiba rubriflora	Malvaceae	Caatinga	ANEMO	6.45	8.11	80.00	150.00	60.00	131.75
Ceiba sp	Malvaceae	Amazon	ANEMO	6.45	8.11	80.00	150.00	60.00	131.75
Ceiba speciosa	Malvaceae	Amazon	ANEMO	6.72	8.56	80.00	167.50	113.00	116.00
Celtis brasiliensis	Canabaceae	Caatinga	ENDO	5.00	3.25	8.00	5.00	64.56	1.00
Celtis iguanaea	Canabaceae	Cerrado	ENDO	5.00	2.50	7.50	9.00	69.11	1.00
Celtis schippii	Canabaceae	Amazon	ENDO	5.00	4.00	8.50	11.19	60.00	1.00
Celtis sp	Canabaceae	Amazon	ENDO	5.00	3.25	8.00	10.56	64.56	1.00

Chaetocarpus echinocarpus	Peraceae	Amazon	ENDO	4.10	5.90	12.00	15.00	70.00	3.00
Chaetocarpus schomburgkianus	Peraceae	Amazon	ENDO	3.22	4.00	4.72	10.65	70.00	3.00
Chomelia estrellana	Rubiaceae	Amazon	ENDO	2.14	11.00	16.60	19.00	45.46	1.00
Chomelia pohliana	Rubiaceae	Caatinga	ENDO	2.14	11.65	5.36	7.53	45.46	1.00
Chomelia sericea	Rubiaceae	Atlantic forest	ENDO	2.14	11.00	6.75	9.63	45.46	1.00
Chromolucuma baehniana	Sapotaceae	Amazon	ENDO	29.00	24.00	45.00	67.50	8422.03	1.00
Chromolucuma rubriflora	Sapotaceae	Amazon	ENDO	29.00	40.00	45.00	67.50	8422.03	1.00
Chrysochlamys ulei	Clusiaceae	Amazon	ENDO	3.53	1.39	9.77	11.14	112.50	3.00
Chrysophyllum amazonicum	Sapotaceae	Amazon	ENDO	8.81	16.18	21.96	33.84	743.57	3.00
Chrysophyllum colombianum	Sapotaceae	Amazon	ENDO	9.40	32.50	26.00	42.50	780.00	3.00
Chrysophyllum cuneifolium	Sapotaceae	Amazon	ENDO	1.75	22.00	25.00	47.50	407.47	4.00
Chrysophyllum flexuosum	Sapotaceae	Atlantic forest	ENDO	7.00	19.00	10.00	28.00	780.00	3.00
Chrysophyllum lucentifolium	Sapotaceae	Amazon	ENDO	6.00	13.70	22.00	25.70	849.40	3.00
Chrysophyllum manaosense	Sapotaceae	Amazon	ENDO	12.50	24.00	26.29	29.02	780.00	3.00
Chrysophyllum marginatum	Sapotaceae	Atlantic forest	ENDO	3.15	5.00	5.70	7.10	111.58	1.00
Chrysophyllum pomiferum	Sapotaceae	Amazon	ENDO	8.00	14.00	26.58	27.25	1145.00	3.00
Chrysophyllum prieurii	Sapotaceae	Amazon	ENDO	13.00	23.00	32.58	31.37	820.00	3.00
Chrysophyllum sanguinolentum	Sapotaceae	Amazon	ENDO	10.00	19.50	52.85	60.44	668.14	3.00
Chrysophyllum sp	Sapotaceae	Amazon	ENDO	9.40	21.80	26.29	30.19	780.00	3.00
Chrysophyllum sparsiflorum	Sapotaceae	Amazon	ENDO	5.85	16.50	18.91	22.36	2008.66	1.00
Chrysophyllum splendens	Sapotaceae	Atlantic forest	ENDO	9.15	16.60	8.50	35.60	416.67	2.00
Chrysophyllum ucuquirana-branca	Sapotaceae	Amazon	ENDO	12.00	21.00	26.29	30.19	780.00	5.00
Chrysophyllum venezuelanense	Sapotaceae	Amazon	ENDO	3.00	27.50	43.34	46.09	810.00	3.00
Chrysophyllum viride	Sapotaceae	Atlantic forest	ENDO	7.50	20.90	25.00	41.00	606.06	3.00
Chrysophyllum wilsonii	Sapotaceae	Amazon	ENDO	9.40	22.50	45.00	30.19	780.00	3.00
Citronella paniculata	Cardiopteridaceae	Atlantic forest	ENDO	11.26	14.40	15.00	23.52	666.67	1.00
Clarisia biflora	Moraceae	Amazon	ENDO	8.40	7.65	10.00	20.00	1645.00	1.00

Clarisia ilicifolia	Moraceae	Amazon	ENDO	9.58	10.30	12.40	15.80	661.36	1.00
Clarisia racemosa	Moraceae	Amazon	ENDO	12.00	17.00	14.95	25.10	1925.00	1.00
Coccoloba declinata	Polygoceae	Caatinga	ENDO	7.50	10.00	7.20	7.70	234.24	1.00
Coccoloba densifrons	Polygoceae	Amazon	ENDO	7.50	10.00	7.45	9.35	172.20	1.00
Coccoloba mollis	Polygoceae	Amazon	ENDO	7.50	10.00	7.70	11.00	282.00	1.00
Coccoloba schwackeana	Polygoceae	Caatinga	ENDO	7.50	10.00	7.45	9.35	234.24	1.00
Coccoloba sp	Polygoceae	Amazon	ENDO	7.50	10.00	7.45	9.35	234.24	1.00
Combretum duarteanum	Combretaceae	Caatinga	ANEMO	4.00	13.00	7.55	14.37	58.76	1.00
Combretum glaucocarpum	Combretaceae	Caatinga	ANEMO	4.00	13.00	18.00	20.50	58.76	1.00
Combretum hilarianum	Combretaceae	Caatinga	ANEMO	4.00	13.00	11.00	11.33	58.76	1.00
Combretum leprosum	Combretaceae	Caatinga	ANEMO	4.00	13.00	20.65	29.55	58.76	1.00
Combretum monetaria	Combretaceae	Caatinga	ANEMO	4.00	13.00	13.00	12.00	58.76	1.00
Commiphora leptophloeos	Burseraceae	Caatinga	ENDO	8.00	11.00	18.00	20.00	188.68	1.00
Compsoneura capitellata	Myristicaceae	Amazon	ENDO	31.00	35.00	10.96	19.32	14900.00	1.00
Compsoneura sp	Myristicaceae	Amazon	ENDO	31.00	35.00	10.96	19.32	7697.65	1.00
Compsoneura ulei	Myristicaceae	Amazon	ENDO	31.00	35.00	10.96	19.32	495.30	1.00
Conceveiba guianensis	Euphorbiaceae	Amazon	ENDO	9.00	9.00	18.74	24.32	130.00	4.50
Connarus erianthus	Connaraceae	Amazon	ENDO	5.00	9.75	12.78	17.37	180.00	1.00
Connarus perrottetii	Connaraceae	Amazon	ENDO	5.50	10.50	13.56	18.86	180.00	1.00
Connarus sp	Connaraceae	Amazon	ENDO	5.00	9.75	12.78	18.86	180.00	1.00
Connarus suberosus	Connaraceae	Cerrado	ENDO	4.50	9.00	12.00	22.00	180.00	1.00
Copaifera arenicola	Fabaceae	Caatinga	ENDO	11.77	17.50	23.51	31.00	352.62	1.00
Copaifera coriacea	Fabaceae	Cerrado	ENDO	11.77	17.50	23.51	31.00	352.62	1.50
Copaifera duckei	Fabaceae	Amazon	ENDO	12.00	18.00	23.51	36.00	445.25	1.50
Copaifera glycycarpa	Fabaceae	Amazon	ENDO	11.77	17.50	23.51	31.00	352.62	1.50
Copaifera langsdorffii	Fabaceae	Atlantic forest	ENDO	11.00	17.00	15.67	27.90	258.16	1.50
Copaifera multijuga	Fabaceae	Amazon	ENDO	13.00	14.00	24.15	33.16	1061.49	1.50

Copaifera sp	Fabaceae	Amazon	ENDO	11.77	17.50	23.51	31.00	352.62	1.50
Copaifera trapezifolia	Fabaceae	Atlantic forest	ENDO	11.53	18.30	23.00	31.00	2000.00	1.00
Cordia alliodora	Boragiceae	Amazon	ENDO	7.00	9.00	10.00	13.40	6.97	1.00
Cordia bicolor	Boragiceae	Amazon	ENDO	7.00	10.00	6.93	10.80	91.97	1.00
Cordia ecalyculata	Boragiceae	Atlantic forest	ENDO	8.00	11.10	7.50	9.00	185.19	1.00
Cordia exaltata	Boragiceae	Amazon	ENDO	7.00	15.00	10.00	10.00	13.60	1.00
Cordia goeldiana	Boragiceae	Amazon	ENDO	7.00	10.00	10.00	13.40	30.37	1.00
Cordia incognita	Boragiceae	Caatinga	ENDO	7.00	10.00	10.00	13.40	13.60	1.00
Cordia lomatoloba	Boragiceae	Amazon	ENDO	9.00	7.00	10.00	19.81	13.60	1.00
Cordia nodosa	Boragiceae	Amazon	ENDO	6.00	10.00	11.00	13.40	290.00	1.00
Cordia oncocalyx	Boragiceae	Caatinga	ENDO	7.00	5.91	13.68	19.95	13.60	1.00
Cordia sagotii	Boragiceae	Amazon	ENDO	7.00	10.00	10.00	13.78	13.60	1.00
Cordia sellowiana	Boragiceae	Atlantic forest	ENDO	13.31	8.30	16.42	10.29	13.60	1.00
Cordia sp	Boragiceae	Caatinga	ENDO	7.00	10.00	10.00	13.40	13.60	1.00
Cordia taguahyensis	Boragiceae	Atlantic forest	ENDO	5.73	10.40	9.00	13.40	13.60	1.00
Cordia trichoclada	Boragiceae	Atlantic forest	ENDO	11.00	15.00	12.17	7.67	13.60	1.00
Cordiera concolor	Rubiaceae	Atlantic forest	ENDO	2.50	3.40	9.50	10.00	12.50	10.00
Cordiera elliptica	Rubiaceae	Atlantic forest	ENDO	1.71	3.48	12.63	14.96	7.14	20.00
Cordiera sessilis	Rubiaceae	Caatinga	ENDO	4.49	6.89	25.48	29.63	22.62	40.00
Corythophora alta	Lecythidaceae	Amazon	SINZO	20.00	37.50	97.50	100.00	377.94	5.00
Corythophora rimosa	Lecythidaceae	Amazon	SINZO	20.00	50.00	97.50	100.00	377.94	5.00
Couepia bracteosa	Chrysobalaceae	Amazon	ENDO	25.00	37.49	28.00	32.50	9090.00	1.00
Couepia caryophylloides	Chrysobalaceae	Amazon	ENDO	25.00	37.49	28.00	32.50	9090.00	1.00
Couepia chrysocalyx	Chrysobalaceae	Amazon	ENDO	31.00	53.50	28.00	32.50	42670.00	1.00
Couepia excelsa	Chrysobalaceae	Amazon	ENDO	25.00	33.00	28.00	32.50	9090.00	1.00
Couepia grandiflora	Chrysobalaceae	Cerrado	ENDO	20.90	31.35	26.50	36.50	9090.00	1.00
Couepia guianensis	Chrysobalaceae	Amazon	ENDO	25.00	33.00	30.00	20.00	1325.62	1.00

Couepia habrantha	Chrysobalaceae	Amazon	ENDO	25.00	33.00	28.00	32.50	9090.00	1.00
Couepia magnoliifolia	Chrysobalaceae	Amazon	ENDO	25.00	33.00	28.00	32.50	9090.00	1.00
Couepia morii	Chrysobalaceae	Amazon	ENDO	25.00	33.00	28.00	32.50	9090.00	1.00
Couepia obovata	Chrysobalaceae	Amazon	ENDO	25.00	33.00	28.00	32.50	9090.00	1.00
Couepia robusta	Chrysobalaceae	Amazon	ENDO	25.00	33.00	28.00	32.50	9090.00	1.00
Couepia sp	Chrysobalaceae	Amazon	ENDO	25.00	33.00	28.00	32.50	9090.00	1.00
Couepia spicata	Chrysobalaceae	Amazon	ENDO	25.00	33.00	28.00	32.50	9090.00	1.00
Couepia ulei	Chrysobalaceae	Amazon	ENDO	25.00	33.00	28.00	32.50	9090.00	1.00
Couepia venosa	Chrysobalaceae	Atlantic forest	ENDO	18.00	20.00	28.00	30.00	9090.00	1.00
Couma guianensis	Apocyaceae	Amazon	ENDO	5.76	11.00	35.00	21.40	500.00	12.00
Couma macrocarpa	Apocyaceae	Amazon	ENDO	8.00	12.00	36.37	37.27	246.10	12.00
Couma utilis	Apocyaceae	Amazon	ENDO	4.10	11.50	10.65	16.48	24.74	12.00
Couratari atrovinosa	Lecythidaceae	Amazon	ANEMO	15.41	55.00	47.27	71.30	125.00	12.00
Couratari guianensis	Lecythidaceae	Amazon	ANEMO	15.41	55.00	47.27	71.30	236.00	22.00
Couratari macrosperma	Lecythidaceae	Amazon	ANEMO	22.71	68.95	47.27	71.30	125.00	17.00
Couratari multiflora	Lecythidaceae	Amazon	ANEMO	15.41	55.00	47.27	71.30	110.00	17.00
Couratari oblongifolia	Lecythidaceae	Amazon	ANEMO	15.00	60.00	47.27	71.30	125.00	17.00
Couratari sp	Lecythidaceae	Amazon	ANEMO	15.41	55.00	47.27	71.30	125.00	17.00
Couratari stellata	Lecythidaceae	Amazon	ANEMO	14.00	55.00	47.27	71.30	125.00	17.00
Couratari tauari	Lecythidaceae	Amazon	ANEMO	20.00	55.00	47.27	71.30	125.00	17.00
Coussapoa microcarpa	Urticaceae	Atlantic forest	ENDO	1.20	2.80	17.00	17.00	2.47	37.30
Coussapoa orthoneura	Urticaceae	Amazon	ENDO	1.50	2.80	17.00	8.95	2.47	20.00
Coussapoa sp	Urticaceae	Atlantic forest	ENDO	1.50	2.80	17.00	8.95	2.47	28.65
Coussapoa trinervia	Urticaceae	Amazon	ENDO	1.60	3.00	17.00	8.00	2.47	28.65
Coussarea accedens	Rubiaceae	Atlantic forest	ENDO	6.61	15.80	6.57	19.46	280.00	1.50
Coussarea albescens	Rubiaceae	Amazon	ENDO	6.61	15.80	7.00	8.00	280.00	1.50
Coussarea ampla	Rubiaceae	Amazon	ENDO	6.61	15.80	6.57	25.73	280.00	1.50

Coussarea brevicaulis	Rubiaceae	Amazon	ENDO	6.61	15.80	6.57	22.77	280.00	1.50
Coussarea macrophylla	Rubiaceae	Amazon	ENDO	6.61	15.80	6.57	20.41	280.00	1.50
Coussarea meridionalis	Rubiaceae	Atlantic forest	ENDO	6.61	15.80	1.00	15.00	280.00	1.50
Coussarea micrococca	Rubiaceae	Amazon	ENDO	6.61	15.80	6.57	20.41	280.00	1.50
Coussarea paniculata	Rubiaceae	Amazon	ENDO	6.61	15.80	6.57	10.30	280.00	1.50
Coussarea sp	Rubiaceae	Amazon	ENDO	6.61	15.80	6.57	20.41	280.00	1.50
Coussarea tenuiflora	Rubiaceae	Amazon	ENDO	6.61	15.80	6.57	20.41	280.00	1.50
Cryptocarya aschersoniana	Lauraceae	Atlantic forest	ENDO	22.00	26.00	20.96	19.55	579.03	1.00
Cryptocarya mandioccana	Lauraceae	Atlantic forest	ENDO	15.00	21.90	16.00	23.00	1148.80	1.00
Cryptocarya moschata	Lauraceae	Atlantic forest	ENDO	22.00	14.04	13.76	19.68	1232.50	1.00
Cryptocarya saligna	Lauraceae	Atlantic forest	ENDO	24.18	45.60	24.00	35.91	1148.80	1.00
Cupania furfuracea	Sapindaceae	Atlantic forest	ENDO	8.00	11.00	21.00	15.50	245.00	1.50
Cupania hirsuta	Sapindaceae	Amazon	ENDO	7.05	10.67	21.00	16.48	212.50	1.50
Cupania hispida	Sapindaceae	Amazon	ENDO	5.93	8.22	21.00	21.13	245.00	1.50
Cupania macrostylis	Sapindaceae	Amazon	ENDO	7.10	8.27	21.00	10.60	245.00	1.50
Cupania oblongifolia	Sapindaceae	Atlantic forest	ENDO	7.05	11.80	24.92	28.25	1100.00	1.50
Cupania paniculata	Sapindaceae	Atlantic forest	ENDO	5.00	10.00	6.60	9.50	245.00	1.50
Cupania racemosa	Sapindaceae	Atlantic forest	ENDO	7.05	13.30	22.62	30.00	769.23	3.00
Cupania scrobiculata	Sapindaceae	Amazon	ENDO	8.60	13.00	22.00	23.50	90.00	1.50
Cupania sp	Sapindaceae	Amazon	ENDO	7.05	10.67	21.00	17.00	245.00	1.50
Cupania vernalis	Sapindaceae	Cerrado	ENDO	6.53	10.67	17.61	19.43	11131.23	3.00
Cupania zanthoxyloides	Sapindaceae	Atlantic forest	ENDO	7.00	10.00	6.60	17.00	245.00	1.50
Curatella americana	Dilleniaceae	Cerrado	ENDO	2.80	4.50	6.75	11.40	17.30	4.00
Cymbopetalum euneurum	Annonaceae	Amazon	ENDO	8.50	12.50	10.00	22.14	217.00	2.50
Cymbopetalum longipes	Annonaceae	Amazon	ENDO	6.50	10.50	10.00	29.00	217.00	6.00
Dacryodes chimantensis	Burseraceae	Amazon	ENDO	13.00	20.00	7.58	16.82	500.00	1.00
Dacryodes cuspidata	Burseraceae	Amazon	ENDO	13.00	20.00	7.58	17.23	500.00	1.00

Dacryodes edilsonii	Burseraceae	Amazon	ENDO	13.00	13.40	7.58	16.82	500.00	1.00
Dacryodes microcarpa	Burseraceae	Amazon	ENDO	13.00	20.00	7.58	11.44	972.55	1.00
Dacryodes nitens	Burseraceae	Amazon	ENDO	13.00	20.00	7.58	16.82	500.00	1.00
Dacryodes sp	Burseraceae	Amazon	ENDO	13.00	20.00	7.58	16.82	500.00	1.00
Dalbergia acuta	Fabaceae	Caatinga	ANEMO	5.20	11.20	14.16	35.12	97.10	1.00
Dalbergia cearensis	Fabaceae	Caatinga	ANEMO	4.00	7.00	21.00	402.00	97.10	1.00
Dalbergia foliolosa	Fabaceae	Caatinga	ANEMO	5.20	11.20	12.57	26.22	97.10	1.00
Dalbergia miscolobium	Fabaceae	Cerrado	ANEMO	10.00	19.50	18.00	50.00	97.10	1.00
Dalbergia nigra	Fabaceae	Atlantic forest	ANEMO	5.20	11.20	10.37	57.10	97.10	1.00
Daphnopsis fasciculata	Thymelaeaceae	Atlantic forest	ENDO	5.00	7.00	7.00	8.00	48.08	1.00
Daphnopsis schwackeana	Thymelaeaceae	Atlantic forest	ENDO	5.00	7.00	7.00	8.00	48.08	1.00
Daphnopsis utilis	Thymelaeaceae	Atlantic forest	ENDO	5.00	7.00	7.00	8.00	48.08	1.00
Deguelia spruceana	Fabaceae	Amazon	ANEMO	1.27	3.39	25.00	135.00	3.67	1.50
Dendropanax cuneatus	Araliaceae	Atlantic forest	ENDO	2.03	4.62	5.71	7.36	5.46	5.00
Dialium guianense	Fabaceae	Atlantic forest	ENDO	8.30	10.60	12.57	18.50	250.00	1.00
Diclinanona calycina	Annonaceae	Amazon	ENDO	9.50	17.50	30.00	51.39	520.80	6.50
Dicorynia paraensis	Fabaceae	Amazon	ANEMO	13.50	17.00	36.50	62.25	425.00	2.00
Dictyoloma vandellianum	Rutaceae	Atlantic forest	ANEMO	3.50	4.75	15.00	15.00	2.00	3.50
Didymopanax angustissimus	Araliaceae	Atlantic forest	ENDO	5.00	6.50	6.73	8.60	20.62	3.00
Didymopanax calvus	Araliaceae	Atlantic forest	ENDO	5.00	5.31	6.96	6.30	10.35	3.00
Didymopanax macrocarpus	Araliaceae	Cerrado	ENDO	5.00	5.31	12.50	7.00	6.39	3.00
Didymopanax morototoni	Araliaceae	Amazon	ENDO	3.75	5.50	4.50	6.00	10.35	3.00
Didymopanax umbrosus	Araliaceae	Amazon	ENDO	6.00	7.00	12.50	7.25	10.35	2.00
Dimorphandra caudata	Fabaceae	Amazon	ENDO	5.00	12.00	25.16	279.73	257.09	17.50
Dimorphandra gardneriana	Fabaceae	Cerrado	ENDO	4.00	12.00	15.00	100.00	257.09	17.50
Dimorphandra mollis	Fabaceae	Cerrado	ENDO	5.37	11.62	32.58	138.03	257.09	17.50
Dimorphandra parviflora	Fabaceae	Amazon	ENDO	5.00	12.00	25.16	125.02	257.09	17.50

Dinizia excelsa	Fabaceae	Amazon	ANEMO	6.00	13.00	45.00	270.00	200.00	7.00
Diospyros capreifolia	Ebeceae	Amazon	ENDO	7.13	15.73	32.50	28.48	426.49	5.00
Diospyros carbonaria	Ebeceae	Amazon	ENDO	7.54	15.37	29.40	28.48	426.49	5.00
Diospyros cavalcantei	Ebeceae	Amazon	ENDO	10.00	16.00	29.40	38.73	426.49	6.00
Diospyros guianensis	Ebeceae	Amazon	ENDO	7.00	15.00	20.00	28.48	426.49	5.00
Diospyros hispida	Ebeceae	Cerrado	ENDO	9.72	20.55	48.38	53.00	426.49	5.00
Diospyros inconstans	Ebeceae	Atlantic forest	ENDO	8.26	13.80	20.00	25.00	421.94	5.00
Diospyros lasiocalyx	Ebeceae	Cerrado	ENDO	7.54	15.37	29.40	24.50	426.49	5.00
Diospyros manausensis	Ebeceae	Amazon	ENDO	7.54	15.37	29.40	28.48	426.49	5.00
Diospyros sericea	Ebeceae	Cerrado	ENDO	7.00	15.00	26.20	31.20	431.04	5.00
Diospyros sp	Ebeceae	Amazon	ENDO	7.54	15.37	29.40	28.48	426.49	5.00
Diospyros vestita	Ebeceae	Amazon	ENDO	6.75	13.50	29.40	26.47	426.49	5.00
Diploon cuspidatum	Sapotaceae	Amazon	ENDO	14.00	31.00	53.50	59.00	1136.00	1.00
Diplotropis brasiliensis	Fabaceae	Amazon	ANEMO	23.00	24.00	25.00	70.00	1250.00	2.00
Diplotropis ferruginea	Fabaceae	Atlantic forest	ANEMO	10.00	17.50	25.00	70.00	1250.00	2.00
Diplotropis martiusii	Fabaceae	Amazon	ANEMO	25.50	29.00	25.00	70.00	2700.00	2.00
Diplotropis purpurea	Fabaceae	Amazon	ANEMO	23.00	24.00	25.00	70.00	134.54	2.00
Diplotropis rodriguesii	Fabaceae	Amazon	ANEMO	23.00	24.00	25.00	70.00	1250.00	2.00
Diplotropis sp	Fabaceae	Amazon	ANEMO	23.00	24.00	25.00	70.00	1250.00	2.00
Diplotropis triloba	Fabaceae	Amazon	ANEMO	23.00	24.00	25.00	70.00	1250.00	2.00
Dipteryx ferrea	Fabaceae	Amazon	SINZO	15.00	35.00	32.33	57.50	5160.00	1.00
Dipteryx magnifica	Fabaceae	Amazon	SINZO	15.00	35.00	30.00	45.00	3064.30	1.00
Dipteryx odorata	Fabaceae	Amazon	SINZO	14.50	37.50	34.00	64.75	5580.00	1.00
Dipteryx polyphylla	Fabaceae	Amazon	SINZO	15.00	35.00	32.33	33.33	5160.00	1.00
Dipteryx punctata	Fabaceae	Amazon	SINZO	20.00	33.50	35.00	71.00	5160.00	1.00
Diptychandra aurantiaca	Fabaceae	Caatinga	ANEMO	30.00	60.00	30.00	120.00	588.00	1.50
Drypetes amazonica	Putranjivaceae	Amazon	ENDO	6.00	10.00	31.00	21.74	175.00	1.00

Drypetes variabilis	Putranjivaceae	Amazon	ENDO	6.00	25.00	31.00	20.80	175.00	1.00
Duckeodendron cestroides	Solaceae	Amazon	SINZO	10.00	10.00	29.64	45.43	14382.44	1.00
Duguetia arenicola	Annonaceae	Amazon	ENDO	5.49	10.00	37.50	47.50	392.72	180.00
Duguetia asterotricha	Annonaceae	Amazon	ENDO	5.49	8.50	37.50	47.50	392.72	180.00
Duguetia calycina	Annonaceae	Amazon	ENDO	5.49	9.00	37.50	47.50	392.72	180.00
Duguetia chrysea	Annonaceae	Amazon	ENDO	5.49	12.00	37.50	47.50	436.87	25.00
Duguetia eximia	Annonaceae	Amazon	ENDO	5.49	14.00	37.50	47.50	392.72	180.00
Duguetia flagellaris	Annonaceae	Amazon	ENDO	5.49	14.00	37.50	47.50	392.72	180.00
Duguetia megalocarpa	Annonaceae	Amazon	ENDO	5.49	27.00	37.50	47.50	392.72	180.00
Duguetia pycnastera	Annonaceae	Amazon	ENDO	5.49	6.00	37.50	47.50	392.72	180.00
Duguetia riedeliana	Annonaceae	Atlantic forest	ENDO	5.49	12.00	37.50	70.00	392.72	180.00
Duguetia riparia	Annonaceae	Amazon	ENDO	4.98	10.00	37.50	47.50	372.02	180.00
Duguetia sp	Annonaceae	Amazon	ENDO	5.49	12.00	37.50	47.50	392.72	180.00
Duguetia stelechantha	Annonaceae	Amazon	ENDO	6.00	14.00	37.50	22.50	392.72	180.00
Duguetia surinamensis	Annonaceae	Amazon	ENDO	5.49	14.00	37.50	47.50	392.72	180.00
Duguetia ulei	Annonaceae	Amazon	ENDO	5.49	12.00	37.50	47.50	392.72	180.00
Dulacia candida	Olacaceae	Amazon	ENDO	6.85	11.99	14.00	20.00	448.59	1.00
Dulacia guianensis	Olacaceae	Amazon	ENDO	11.00	14.00	19.22	21.65	1410.16	1.00
Ecclinusa guianensis	Sapotaceae	Amazon	ENDO	10.76	15.64	28.47	28.34	838.15	3.00
Ecclinusa lanceolata	Sapotaceae	Amazon	ENDO	11.55	18.52	30.00	24.76	838.15	4.50
Ecclinusa ramiflora	Sapotaceae	Atlantic forest	ENDO	10.00	22.00	30.00	34.79	838.15	1.50
Ecclinusa sp	Sapotaceae	Amazon	ENDO	10.76	21.00	30.00	28.34	838.15	3.00
Emmotum acuminatum	Metteniusaceae	Amazon	ENDO	12.44	14.78	20.41	17.06	350.86	1.00
Emmotum fagifolium	Metteniusaceae	Amazon	ENDO	12.44	14.78	15.00	17.06	460.00	1.00
Emmotum nitens	Metteniusaceae	Cerrado	ENDO	12.44	14.78	22.71	17.06	241.73	1.00
Emmotum sp	Metteniusaceae	Amazon	ENDO	12.44	14.78	20.41	17.06	350.86	1.00
Endlicheria bracteolata	Lauraceae	Amazon	ENDO	6.00	12.00	8.00	15.00	240.00	1.00

Endlicheria chalisea	Lauraceae	Amazon	ENDO	6.50	13.00	12.58	21.91	310.00	1.00
Endlicheria longicaudata	Lauraceae	Amazon	ENDO	6.50	13.00	12.58	22.00	310.00	1.00
Endlicheria macrophylla	Lauraceae	Amazon	ENDO	6.50	13.00	12.58	25.94	310.00	1.00
Endlicheria multiflora	Lauraceae	Amazon	ENDO	6.50	13.00	12.58	14.12	310.00	1.00
Endlicheria paniculata	Lauraceae	Atlantic forest	ENDO	12.50	18.70	14.08	23.25	669.05	1.00
Endlicheria punctulata	Lauraceae	Amazon	ENDO	6.50	13.00	15.00	21.91	310.00	1.00
Endlicheria sericea	Lauraceae	Amazon	ENDO	6.50	13.00	12.58	21.91	310.00	1.00
Endlicheria sp	Lauraceae	Amazon	ENDO	6.50	13.00	12.58	21.91	310.00	1.00
Endlicheria sprucei	Lauraceae	Amazon	ENDO	6.50	13.00	12.58	18.65	310.00	1.00
Enterolobium gummiferum	Fabaceae	Cerrado	ENDO	8.51	18.25	50.00	70.00	502.25	14.00
Enterolobium maximum	Fabaceae	Amazon	ENDO	9.29	13.96	37.00	70.00	656.26	14.00
Enterolobium schomburgkii	Fabaceae	Amazon	ENDO	4.75	9.00	24.00	70.00	55.00	14.00
Enterolobium sp	Fabaceae	Amazon	ENDO	5.01	15.98	37.00	70.00	62.80	14.00
Eperua duckeana	Fabaceae	Amazon	SINZO	25.00	40.00	46.11	121.88	6463.55	1.50
Eperua glabriflora	Fabaceae	Amazon	SINZO	25.00	40.00	46.11	121.88	6463.55	1.00
Eperua purpurea	Fabaceae	Amazon	SINZO	25.00	40.00	46.11	121.88	6463.55	1.00
Eperua sp	Fabaceae	Amazon	SINZO	25.00	40.00	46.11	121.88	6463.55	1.00
Ephedranthus amazonicus	Annonaceae	Amazon	ENDO	7.00	18.00	18.33	17.00	1005.87	23.00
Ephedranthus parviflorus	Annonaceae	Amazon	ENDO	7.00	15.00	9.00	17.00	1005.87	15.25
Ephedranthus pisocarpus	Annonaceae	Caatinga	ENDO	7.00	10.00	13.67	16.39	1005.87	7.50
Eremanthus elaeagnus	Asteraceae	Cerrado	ANEMO	1.00	6.00	1.31	2.59	2.19	1.00
Eremanthus erythropappus	Asteraceae	Atlantic forest	ANEMO	1.00	6.00	1.31	2.00	2.19	1.00
Eremanthus glomerulatus	Asteraceae	Cerrado	ANEMO	1.00	6.00	1.31	2.59	2.19	1.00
Eremanthus incanus	Asteraceae	Cerrado	ANEMO	1.00	6.00	15.00	90.00	2.19	1.00
Eriotheca candolleana	Malvaceae	Atlantic forest	ANEMO	5.41	7.50	31.48	35.16	52.63	20.25
Eriotheca globosa	Malvaceae	Atlantic forest	ANEMO	4.00	6.00	37.00	41.00	52.63	20.25
Eriotheca gracilipes	Malvaceae	Cerrado	ANEMO	7.00	6.75	30.33	54.83	52.63	18.50

Eriotheca longipedicellata	Malvaceae	Amazon	ANEMO	6.21	7.50	37.00	49.67	52.63	20.25
Eriotheca pentaphylla	Malvaceae	Atlantic forest	ANEMO	13.00	15.00	60.00	72.00	52.63	20.25
Eriotheca pubescens	Malvaceae	Cerrado	ANEMO	6.21	7.50	39.21	98.01	52.63	22.00
Eriotheca sp	Malvaceae	Amazon	ANEMO	6.21	7.50	37.00	49.67	52.63	20.25
Erisma bicolor	Vochysiaceae	Amazon	ANEMO	24.13	88.00	21.50	60.00	490.60	42.00
Erisma bracteosum	Vochysiaceae	Amazon	ANEMO	24.13	88.00	21.50	110.00	476.19	1.00
Erisma sp	Vochysiaceae	Amazon	ANEMO	24.13	88.00	21.50	61.50	490.60	1.00
Erisma uncinatum	Vochysiaceae	Amazon	ANEMO	24.13	88.00	21.50	61.50	505.00	1.00
Erythrina fusca	Fabaceae	Amazon	ENDO	7.73	12.75	15.11	176.55	427.32	2.00
Erythrina mulungu	Fabaceae	Amazon	ENDO	5.37	10.31	11.25	124.78	118.69	2.00
Erythrina sp	Fabaceae	Amazon	ENDO	7.38	10.50	13.15	130.34	397.77	2.00
Erythroxylum barbatum	Erythroxylaceae	Caatinga	ENDO	4.02	7.75	4.00	6.97	60.15	1.00
Erythroxylum betulaceum	Erythroxylaceae	Caatinga	ENDO	4.02	7.75	4.00	7.00	60.15	1.00
Erythroxylum citrifolium	Erythroxylaceae	Amazon	ENDO	4.02	7.75	3.70	8.00	214.00	1.00
Erythroxylum deciduum	Erythroxylaceae	Cerrado	ENDO	4.70	8.59	4.00	11.00	60.15	1.00
Erythroxylum macrophyllum	Erythroxylaceae	Amazon	ENDO	5.00	11.00	4.00	6.80	120.00	1.00
Erythroxylum mucronatum	Erythroxylaceae	Amazon	ENDO	4.02	7.75	5.00	12.00	60.15	1.00
Erythroxylum sp	Erythroxylaceae	Amazon	ENDO	4.02	7.75	4.00	7.00	60.15	1.00
Erythroxylum suberosum	Erythroxylaceae	Cerrado	ENDO	3.34	6.90	6.20	8.50	43.39	1.00
Erythroxylum subrotundum	Erythroxylaceae	Caatinga	ENDO	4.02	7.75	3.60	6.20	60.15	1.00
Erythroxylum tortuosum	Erythroxylaceae	Cerrado	ENDO	3.12	6.29	4.56	6.48	29.64	1.00
Eschweilera albiflora	Lecythidaceae	Amazon	SINZO	15.00	25.00	55.00	47.50	1970.82	4.00
Eschweilera amazonica	Lecythidaceae	Amazon	SINZO	8.00	5.00	60.00	32.50	1970.82	8.50
Eschweilera amazoniciformis	Lecythidaceae	Amazon	SINZO	12.11	22.62	45.00	50.00	1661.94	2.50
Eschweilera apiculata	Lecythidaceae	Amazon	SINZO	25.00	23.00	40.00	30.00	1970.82	2.25
Eschweilera atropetiolata	Lecythidaceae	Amazon	SINZO	16.00	22.50	70.00	65.00	2406.69	5.75
Eschweilera bracteosa	Lecythidaceae	Amazon	SINZO	16.00	22.00	44.50	32.50	1391.10	4.50

Eschweilera carinata	Lecythidaceae	Amazon	SINZO	17.50	23.00	44.50	32.50	1608.01	4.00
Eschweilera chartaceifolia	Lecythidaceae	Amazon	SINZO	10.00	20.00	42.50	32.50	1970.82	2.25
Eschweilera collina	Lecythidaceae	Amazon	SINZO	15.00	22.00	47.50	47.50	1970.82	2.25
Eschweilera coriacea	Lecythidaceae	Amazon	SINZO	20.50	26.25	53.75	36.25	4212.40	6.25
Eschweilera cyathiformis	Lecythidaceae	Amazon	SINZO	12.50	25.00	32.50	37.50	1172.00	2.25
Eschweilera decolorans	Lecythidaceae	Amazon	SINZO	21.00	23.00	64.00	38.25	2024.21	2.50
Eschweilera grandiflora	Lecythidaceae	Amazon	SINZO	20.50	26.25	58.50	32.50	1418.33	3.25
Eschweilera laevicarpa	Lecythidaceae	Amazon	SINZO	17.50	23.00	44.50	32.50	1970.82	2.25
Eschweilera micrantha	Lecythidaceae	Amazon	SINZO	13.75	21.25	44.50	27.00	1970.82	2.00
Eschweilera nana	Lecythidaceae	Cerrado	SINZO	23.75	31.00	62.50	62.25	1970.82	2.00
Eschweilera ovalifolia	Lecythidaceae	Amazon	SINZO	22.50	27.50	67.50	45.00	6663.00	3.25
Eschweilera ovata	Lecythidaceae	Amazon	SINZO	16.64	23.38	32.50	30.00	1907.50	2.00
Eschweilera parviflora	Lecythidaceae	Amazon	SINZO	17.50	23.00	25.00	17.50	2000.00	2.25
Eschweilera parvifolia	Lecythidaceae	Amazon	SINZO	25.00	30.00	44.50	32.50	1970.82	2.25
Eschweilera pedicellata	Lecythidaceae	Amazon	SINZO	17.25	23.25	37.50	31.25	1970.82	4.00
Eschweilera piresii	Lecythidaceae	Amazon	SINZO	17.50	23.00	44.50	32.50	1970.82	2.25
Eschweilera pseudodecolorans	Lecythidaceae	Amazon	SINZO	17.50	20.50	44.50	32.50	1876.57	1.50
Eschweilera rankiniae	Lecythidaceae	Amazon	SINZO	11.00	19.00	27.75	23.75	1970.82	1.00
Eschweilera rhododendrifolia	Lecythidaceae	Amazon	SINZO	17.50	23.00	76.50	64.50	1970.82	2.25
Eschweilera romeu-cardosoi	Lecythidaceae	Amazon	SINZO	20.00	25.00	28.50	24.50	2195.64	1.00
Eschweilera sagotiana	Lecythidaceae	Amazon	SINZO	15.50	14.50	46.25	28.75	1970.82	2.00
Eschweilera sp	Lecythidaceae	Amazon	SINZO	17.50	23.00	44.50	32.50	1970.82	2.25
Eschweilera subglandulosa	Lecythidaceae	Amazon	SINZO	17.50	23.00	42.50	27.50	1970.82	2.25
Eschweilera tenuifolia	Lecythidaceae	Amazon	SINZO	16.50	41.00	85.00	41.50	3140.00	13.50
Eschweilera tessmannii	Lecythidaceae	Amazon	SINZO	17.50	23.00	44.50	32.50	1553.97	2.00
Eschweilera truncata	Lecythidaceae	Amazon	SINZO	22.00	23.00	27.00	22.50	1172.00	1.50
Eschweilera wachenheimii	Lecythidaceae	Amazon	SINZO	12.11	13.99	30.00	22.50	1005.96	1.50

Eugenia acutata	Myrtaceae	Atlantic forest	ENDO	18.00	14.30	23.00	22.00	3600.00	1.00
Eugenia agathopoda	Myrtaceae	Amazon	ENDO	7.38	9.10	11.00	12.52	454.65	1.00
Eugenia astringens	Myrtaceae	Amazon	ENDO	12.11	13.62	11.00	7.70	454.65	1.00
Eugenia aurata	Myrtaceae	Cerrado	ENDO	7.38	7.44	9.60	8.00	454.65	1.00
Eugenia batingabranca	Myrtaceae	Atlantic forest	ENDO	6.46	7.70	6.78	8.88	454.65	1.00
Eugenia belemitana	Myrtaceae	Amazon	ENDO	7.38	9.10	11.00	12.52	454.65	1.00
Eugenia bimarginata	Myrtaceae	Atlantic forest	ENDO	7.38	9.10	12.70	12.52	250.00	1.00
Eugenia cerasiflora	Myrtaceae	Atlantic forest	ENDO	10.00	14.00	11.00	16.00	944.12	1.00
Eugenia cereja	Myrtaceae	Atlantic forest	ENDO	7.38	9.10	12.70	19.30	454.65	1.00
Eugenia copacabanensis	Myrtaceae	Atlantic forest	ENDO	20.00	20.00	13.50	16.70	2350.00	1.00
Eugenia cucullata	Myrtaceae	Amazon	ENDO	7.38	9.10	23.50	12.52	495.67	1.00
Eugenia cupulata	Myrtaceae	Amazon	ENDO	4.00	9.10	11.00	12.52	454.65	1.00
Eugenia cuspidifolia	Myrtaceae	Amazon	ENDO	5.00	8.00	11.00	18.58	454.65	1.00
Eugenia disperma	Myrtaceae	Atlantic forest	ENDO	7.38	9.10	11.00	12.52	454.65	1.00
Eugenia dysenterica	Myrtaceae	Cerrado	ENDO	8.69	14.72	31.14	35.05	625.00	2.50
Eugenia excelsa	Myrtaceae	Atlantic forest	ENDO	5.80	5.30	7.50	7.00	454.65	1.00
Eugenia expansa	Myrtaceae	Atlantic forest	ENDO	7.38	4.75	14.74	12.52	454.65	1.00
Eugenia flavescens	Myrtaceae	Caatinga	ENDO	7.38	9.10	11.00	8.92	454.65	1.00
Eugenia florida	Myrtaceae	Atlantic forest	ENDO	8.06	10.00	10.49	9.95	454.65	1.00
Eugenia fusca	Myrtaceae	Atlantic forest	ENDO	6.50	9.10	11.00	24.00	454.65	1.00
Eugenia hiemalis	Myrtaceae	Atlantic forest	ENDO	7.38	9.10	5.70	8.80	96.23	2.00
Eugenia lambertiana	Myrtaceae	Atlantic forest	ENDO	8.00	9.10	11.00	15.88	454.65	1.00
Eugenia ligustrina	Myrtaceae	Caatinga	ENDO	4.85	9.10	10.15	6.00	324.40	2.00
Eugenia longiracemosa	Myrtaceae	Amazon	ENDO	6.30	4.29	7.03	4.87	135.83	1.00
Eugenia macahensis	Myrtaceae	Atlantic forest	ENDO	7.38	9.10	3.00	12.52	454.65	1.00
Eugenia mansoi	Myrtaceae	Atlantic forest	ENDO	4.20	9.10	11.00	4.00	454.65	1.00
Eugenia melanogyna	Myrtaceae	Atlantic forest	ENDO	21.00	9.10	3.00	34.00	7000.00	1.00

Eugenia monosperma	Myrtaceae	Atlantic forest	ENDO	7.38	19.50	11.00	12.52	454.65	1.00
Eugenia mosenii	Myrtaceae	Atlantic forest	ENDO	19.00	9.10	13.90	24.00	4000.00	1.00
Eugenia omissa	Myrtaceae	Amazon	ENDO	6.00	9.00	3.00	7.05	454.65	1.00
Eugenia patens	Myrtaceae	Amazon	ENDO	7.38	9.10	11.00	13.13	454.65	1.00
Eugenia patrisii	Myrtaceae	Amazon	ENDO	7.38	15.50	32.00	38.00	536.81	1.00
Eugenia pisiformis	Myrtaceae	Atlantic forest	ENDO	9.20	6.60	11.00	11.51	454.65	1.00
Eugenia polystachya	Myrtaceae	Amazon	ENDO	7.38	9.10	11.00	8.65	454.65	1.00
Eugenia prasina	Myrtaceae	Atlantic forest	ENDO	9.41	18.90	9.70	18.20	454.65	1.00
Eugenia protenta	Myrtaceae	Amazon	ENDO	5.00	8.00	11.00	6.72	454.65	1.00
Eugenia pseudopsidium	Myrtaceae	Amazon	ENDO	7.38	9.10	11.00	12.00	454.65	1.00
Eugenia ramiflora	Myrtaceae	Amazon	ENDO	7.38	9.10	11.00	29.46	454.65	1.00
Eugenia sonderiana	Myrtaceae	Atlantic forest	ENDO	5.00	6.60	8.00	9.00	146.06	1.00
Eugenia sp	Myrtaceae	Cerrado	ENDO	7.38	9.10	11.00	12.52	454.65	1.00
Eugenia stictopetala	Myrtaceae	Amazon	ENDO	7.38	1.90	9.65	16.35	454.65	9.00
Eugenia stipitata	Myrtaceae	Amazon	ENDO	7.38	9.10	52.80	70.00	1624.20	1.00
Eugenia subavenia	Myrtaceae	Atlantic forest	ENDO	7.38	9.10	6.90	9.90	454.65	1.00
Eugenia tenuipedunculata	Myrtaceae	Atlantic forest	ENDO	7.38	9.10	11.00	12.52	380.00	1.00
Eugenia uniflora	Myrtaceae	Caatinga	ENDO	11.40	16.00	18.00	25.00	328.00	1.00
Euterpe edulis	Arecaceae	Atlantic forest	ENDO	9.88	11.34	11.57	12.42	474.84	1.00
Euterpe oleracea	Arecaceae	Amazon	ENDO	9.63	9.63	12.00	10.00	190.00	1.00
Euterpe precatoria	Arecaceae	Amazon	ENDO	7.00	6.00	10.00	12.03	173.00	1.00
Faramea capillipes	Rubiaceae	Amazon	ENDO	5.40	5.80	5.83	6.00	135.00	1.00
Faramea corymbosa	Rubiaceae	Amazon	ENDO	5.40	5.40	5.00	6.79	170.00	1.00
Faramea juruana	Rubiaceae	Amazon	ENDO	5.40	5.40	5.83	9.39	170.00	1.00
Faramea marginata	Rubiaceae	Atlantic forest	ENDO	5.40	5.40	7.00	9.39	170.00	1.00
Faramea occidentalis	Rubiaceae	Amazon	ENDO	5.40	5.40	6.20	6.30	232.11	1.00
Faramea pachyantha	Rubiaceae	Atlantic forest	ENDO	5.40	5.40	2.00	9.39	170.00	1.00

Faramea paratiensis	Rubiaceae	Atlantic forest	ENDO	5.40	5.40	5.83	14.09	170.00	1.00
Faramea sp	Rubiaceae	Amazon	ENDO	5.40	5.40	5.83	9.39	170.00	1.00
Faramea torquata	Rubiaceae	Amazon	ENDO	5.00	5.00	5.83	11.86	170.00	1.00
Ficus adhatodifolia	Moraceae	Atlantic forest	ENDO	1.03	1.13	10.50	10.67	0.20	156.00
Ficus amazonica	Moraceae	Amazon	ENDO	1.03	1.10	10.50	17.49	0.23	50.00
Ficus paraensis	Moraceae	Amazon	ENDO	1.03	1.10	10.50	21.97	0.23	50.00
Ficus sp	Moraceae	Amazon	ENDO	1.03	1.10	10.50	17.49	0.23	50.00
Ficus trigona	Moraceae	Amazon	ENDO	0.80	1.05	10.00	11.50	0.25	50.00
Garcinia brasiliensis	Clusiaceae	Amazon	ENDO	16.75	22.80	34.94	31.44	960.00	2.50
Garcinia gardneriana	Clusiaceae	Atlantic forest	ENDO	14.40	26.00	33.95	39.89	1472.50	2.50
Garcinia macrophylla	Clusiaceae	Amazon	ENDO	20.00	41.60	51.80	80.00	743.00	2.50
Garcinia madruno	Clusiaceae	Amazon	ENDO	13.50	26.41	28.00	45.00	6130.60	2.50
Garcinia sp	Clusiaceae	Amazon	ENDO	14.40	26.00	33.30	42.45	3604.40	2.50
Geissospermum argenteum	Apocyaceae	Amazon	ENDO	21.50	27.00	30.92	36.13	179.04	8.00
Geissospermum laeve	Apocyaceae	Cerrado	ENDO	15.00	14.80	23.86	43.50	90.00	8.00
Geissospermum reticulatum	Apocyaceae	Amazon	ENDO	16.19	17.90	26.24	46.06	235.22	8.00
Geissospermum sericeum	Apocyaceae	Amazon	ENDO	9.90	12.70	29.92	41.86	370.00	8.00
Geissospermum urceolatum	Apocyaceae	Amazon	ENDO	16.50	21.50	26.24	3.00	291.40	8.00
Genipa americana	Rubiaceae	Amazon	ENDO	4.35	7.90	66.50	75.00	115.60	50.00
Geoffroea spinosa	Fabaceae	Caatinga	SINZO	10.00	22.50	23.04	33.04	3260.25	1.00
Glycydendron amazonicum	Euphorbiaceae	Amazon	ENDO	87.16	170.33	15.00	28.80	2049.08	1.00
Goupia glabra	Goupiaceae	Amazon	ENDO	1.00	2.50	6.00	4.50	0.76	3.00
Guapira graciliflora	Nyctagiceae	Cerrado	ENDO	4.46	8.52	5.76	7.27	142.86	1.00
Guapira hirsuta	Nyctagiceae	Atlantic forest	ENDO	4.00	10.00	6.51	8.00	162.93	1.00
Guapira nitida	Nyctagiceae	Atlantic forest	ENDO	4.70	8.20	6.51	12.40	162.93	1.00
Guapira noxia	Nyctagiceae	Cerrado	ENDO	4.00	9.00	6.70	5.80	50.00	1.00
Guapira opposita	Nyctagiceae	Atlantic forest	ENDO	3.84	6.75	6.53	6.95	241.50	1.00

Guapira sp	Nyctagiceae	Amazon	ENDO	4.00	8.20	6.51	7.77	162.93	1.00
Guapira venosa	Nyctagiceae	Amazon	ENDO	4.00	8.20	6.51	10.00	162.93	1.00
Guarea carinata	Meliaceae	Amazon	ENDO	9.00	15.00	22.00	22.54	495.30	12.00
Guarea cinnamomea	Meliaceae	Amazon	ENDO	7.00	24.50	22.00	22.54	370.47	7.00
Guarea convergens	Meliaceae	Amazon	ENDO	7.00	17.50	22.00	23.06	370.47	7.00
Guarea grandifolia	Meliaceae	Amazon	ENDO	17.00	12.00	22.00	22.54	611.81	7.00
Guarea guidonia	Meliaceae	Atlantic forest	ENDO	7.00	12.00	12.00	19.00	250.80	4.00
Guarea humaitensis	Meliaceae	Amazon	ENDO	7.00	10.00	22.00	15.97	370.47	7.00
Guarea kunthiana	Meliaceae	Atlantic forest	ENDO	9.00	20.00	35.00	37.50	100.00	8.00
Guarea macrophylla	Meliaceae	Atlantic forest	ENDO	8.60	12.80	20.00	13.00	281.50	7.00
Guarea pterorhachis	Meliaceae	Amazon	ENDO	12.00	13.00	20.00	22.00	377.94	7.00
Guarea pubescens	Meliaceae	Amazon	ENDO	5.32	7.84	22.00	10.72	370.47	7.00
Guarea purusana	Meliaceae	Amazon	ENDO	7.00	12.00	29.10	35.35	370.47	7.00
Guarea scabra	Meliaceae	Amazon	ENDO	7.00	10.00	22.00	14.89	370.47	7.00
Guarea silvatica	Meliaceae	Amazon	ENDO	7.00	12.00	22.91	35.09	467.00	2.00
Guarea sp	Meliaceae	Amazon	ENDO	7.00	12.00	22.00	22.54	370.47	7.00
Guarea trunciflora	Meliaceae	Amazon	ENDO	10.00	17.00	22.00	49.50	370.47	7.00
Guatteria australis	Annonaceae	Atlantic forest	ENDO	7.00	9.05	6.00	12.00	78.43	40.00
Guatteria blepharophylla	Annonaceae	Amazon	ENDO	7.50	20.00	6.00	20.78	174.05	40.00
Guatteria citriodora	Annonaceae	Amazon	ENDO	5.50	7.00	4.94	6.52	174.05	40.00
Guatteria decurrens	Annonaceae	Amazon	ENDO	8.00	17.50	9.50	20.00	410.00	40.00
Guatteria discolor	Annonaceae	Amazon	ENDO	7.50	15.00	6.00	17.77	174.05	40.00
Guatteria friesiana	Annonaceae	Amazon	ENDO	7.00	16.00	6.50	21.00	174.05	40.00
Guatteria guianensis	Annonaceae	Amazon	ENDO	7.50	20.00	6.00	20.28	174.05	40.00
Guatteria hispida	Annonaceae	Amazon	ENDO	6.50	18.50	6.00	27.33	174.05	40.00
Guatteria megalophylla	Annonaceae	Amazon	ENDO	10.50	18.50	6.00	23.85	174.05	40.00
Guatteria meliodora	Annonaceae	Amazon	ENDO	6.25	20.00	12.00	13.61	174.05	40.00

Guatteria pohliana	Annonaceae	Atlantic forest	ENDO	5.00	6.00	5.00	8.00	174.05	40.00
Guatteria procera	Annonaceae	Amazon	ENDO	4.00	9.50	6.00	10.00	174.05	40.00
Guatteria punctata	Annonaceae	Amazon	ENDO	6.00	9.00	6.50	12.25	174.05	40.00
Guatteria schomburgkiana	Annonaceae	Atlantic forest	ENDO	5.50	6.50	5.50	3.50	174.05	40.00
Guatteria scytophylla	Annonaceae	Amazon	ENDO	5.50	8.00	6.00	8.65	174.05	40.00
Guatteria ucayalina	Annonaceae	Amazon	ENDO	5.50	9.00	6.00	13.01	174.05	40.00
Guatteria villosissima	Annonaceae	Atlantic forest	ENDO	4.00	6.00	4.80	8.20	174.05	40.00
Guazuma ulmifolia	Malvaceae	Cerrado	ENDO	1.84	2.87	21.58	27.81	4.00	50.00
Guettarda uruguensis	Rubiaceae	Cerrado	ENDO	11.50	13.64	4.60	9.50	610.00	1.00
Guettarda viburnoides	Rubiaceae	Caatinga	ENDO	11.50	13.64	11.91	12.10	416.67	1.00
Gustavia augusta	Lecythidaceae	Amazon	ENDO	120.00	185.00	22.99	68.63	175.00	6.00
Gustavia elliptica	Lecythidaceae	Amazon	ENDO	7.50	12.50	20.00	29.98	175.00	9.00
Gustavia hexapetala	Lecythidaceae	Amazon	ENDO	17.00	20.50	22.99	26.30	175.00	3.00
Gustavia poeppigiana	Lecythidaceae	Amazon	ENDO	17.00	185.00	45.00	47.52	175.00	6.00
Gustavia sp	Lecythidaceae	Amazon	ENDO	17.00	21.00	22.99	39.69	175.00	6.00
Handroanthus catarinensis	Bignoniaceae	Atlantic forest	ANEMO	11.50	22.30	16.50	90.50	778.89	123.36
Handroanthus impetiginosus	Bignoniaceae	Caatinga	ANEMO	12.30	22.30	16.17	263.83	778.89	116.71
Handroanthus incanus	Bignoniaceae	Amazon	ANEMO	11.50	22.30	12.33	163.00	778.89	123.36
Handroanthus ochraceus	Bignoniaceae	Caatinga	ANEMO	11.50	15.30	15.33	196.50	778.89	123.36
Handroanthus selachidentatus	Bignoniaceae	Caatinga	ANEMO	11.50	22.30	6.33	115.33	778.89	36.50
Handroanthus serratifolius	Bignoniaceae	Caatinga	ANEMO	8.00	45.00	8.33	193.00	778.89	36.50
Heisteria acuminata	Olacaceae	Amazon	ENDO	5.00	7.00	7.52	10.51	55.00	1.00
Heisteria barbata	Olacaceae	Amazon	ENDO	5.40	7.48	6.50	9.33	70.00	1.00
Heisteria densifrons	Olacaceae	Amazon	ENDO	5.40	7.48	6.00	8.48	70.00	1.00
Heisteria nitida	Olacaceae	Amazon	ENDO	5.40	7.48	7.88	9.53	134.56	1.00
Heisteria ovata	Olacaceae	Amazon	ENDO	6.50	13.00	6.25	11.00	70.00	1.00
Heisteria sp	Olacaceae	Amazon	ENDO	5.40	7.48	6.80	9.61	70.00	1.00

Heisteria spruceana	Olacaceae	Amazon	ENDO	5.40	7.48	6.80	9.67	70.00	1.00
Helicostylis elegans	Moraceae	Amazon	ENDO	5.95	7.98	21.50	20.89	147.18	7.50
Helicostylis pedunculata	Moraceae	Amazon	ENDO	4.00	6.00	25.00	12.50	147.18	7.50
Helicostylis scabra	Moraceae	Amazon	ENDO	5.95	7.98	11.76	18.79	147.18	7.50
Helicostylis sp	Moraceae	Amazon	ENDO	5.95	8.40	21.50	20.69	147.18	7.50
Helicostylis tomentosa	Moraceae	Atlantic forest	ENDO	7.90	8.85	21.50	22.30	167.00	7.50
Helicostylis turbinata	Moraceae	Amazon	ENDO	5.95	8.40	21.50	20.69	147.18	7.50
Hevea brasiliensis	Euphorbiaceae	Amazon	SINZO	17.50	26.00	33.50	30.00	3945.00	3.00
Hevea guianensis	Euphorbiaceae	Amazon	SINZO	17.50	19.00	33.50	33.75	894.31	3.00
Hevea sp	Euphorbiaceae	Amazon	SINZO	17.50	20.00	33.50	32.50	3630.00	3.00
Himatanthus articulatus	Apocyaceae	Amazon	ANEMO	27.00	39.50	28.21	173.84	31.75	13.00
Himatanthus drasticus	Apocyaceae	Caatinga	ANEMO	27.00	39.50	23.00	182.00	31.75	13.00
Himatanthus revolutus	Apocyaceae	Amazon	ANEMO	27.00	39.50	25.61	177.92	31.75	42.00
Hirtella bicornis	Chrysobalaceae	Amazon	ENDO	3.80	9.20	4.50	9.00	172.00	1.00
Hirtella brachystachya	Chrysobalaceae	Amazon	ENDO	3.80	9.20	6.50	15.00	172.00	1.00
Hirtella ciliata	Chrysobalaceae	Cerrado	ENDO	5.00	9.20	7.00	9.00	84.52	1.00
Hirtella duckei	Chrysobalaceae	Amazon	ENDO	3.80	9.20	6.50	13.86	172.00	1.00
Hirtella eriandra	Chrysobalaceae	Amazon	ENDO	3.80	9.20	6.50	31.00	172.00	1.00
Hirtella excelsa	Chrysobalaceae	Amazon	ENDO	1.15	1.58	6.50	18.57	172.00	1.00
Hirtella fasciculata	Chrysobalaceae	Amazon	ENDO	3.80	9.20	6.50	15.00	172.00	1.00
Hirtella hebeclada	Chrysobalaceae	Atlantic forest	ENDO	2.60	13.85	12.00	19.65	172.00	1.00
Hirtella martiana	Chrysobalaceae	Atlantic forest	ENDO	10.00	20.00	13.50	25.00	172.00	1.00
Hirtella obidensis	Chrysobalaceae	Amazon	ENDO	3.80	9.20	6.50	14.94	172.00	1.00
Hirtella physophora	Chrysobalaceae	Amazon	ENDO	3.80	9.20	6.50	13.44	172.00	1.00
Hirtella racemosa	Chrysobalaceae	Amazon	ENDO	7.91	13.32	5.00	11.00	130.50	1.00
Hirtella rodriguesii	Chrysobalaceae	Amazon	ENDO	3.80	9.20	6.00	15.00	172.00	1.00
Hirtella sp	Chrysobalaceae	Amazon	ENDO	3.80	9.20	6.50	15.00	172.00	1.00

Hirtella triandra	Chrysobalaceae	Amazon	ENDO	1.35	2.69	5.10	1.00	176.00	1.00
Humiria balsamifera	Humiriaceae	Amazon	ENDO	4.10	5.80	5.20	7.60	153.85	5.00
Hyeronima alchorneoides	Phyllanthaceae	Atlantic forest	ENDO	2.00	3.60	4.00	4.00	14.39	1.00
Hymenaea courbaril	Fabaceae	Amazon	SINZO	14.58	27.72	40.00	120.00	4113.50	4.50
Hymenaea intermedia	Fabaceae	Amazon	ENDO	11.16	17.66	26.35	41.34	1661.94	4.00
Hymenaea oblongifolia	Fabaceae	Amazon	ENDO	11.00	21.00	39.00	55.00	2108.48	2.00
Hymenaea parvifolia	Fabaceae	Amazon	SINZO	14.58	24.00	30.00	40.00	2406.69	1.50
Hymenaea reticulata	Fabaceae	Amazon	ENDO	14.58	20.17	64.77	133.96	1742.62	5.00
Hymenaea sp	Fabaceae	Amazon	ENDO	14.58	20.17	40.75	86.77	1702.28	5.00
Hymenaea stigonocarpa	Fabaceae	Cerrado	ENDO	18.47	20.34	42.88	123.88	1702.28	7.00
Hymenaea velutina	Fabaceae	Caatinga	ENDO	14.58	20.17	40.75	75.79	1702.28	5.00
Hymenopus adolphoduckei	Chrysobalaceae	Amazon	SINZO	38.00	57.00	47.00	72.50	52400.00	1.00
Hymenopus caudatus	Chrysobalaceae	Amazon	SINZO	9.00	16.00	10.00	21.50	8000.00	1.00
Hymenopus heteromorphus	Chrysobalaceae	Amazon	SINZO	28.00	31.00	28.00	31.00	13800.00	1.00
Hymenopus hirsutus	Chrysobalaceae	Amazon	SINZO	33.00	44.00	36.50	30.50	33100.00	1.00
Hymenopus intrapetiolaris	Chrysobalaceae	Amazon	SINZO	33.00	44.00	150.00	30.50	33100.00	1.00
Hymenopus laevigatus	Chrysobalaceae	Amazon	SINZO	33.00	44.00	36.50	30.50	33100.00	1.00
Hymenopus latifolius	Chrysobalaceae	Amazon	SINZO	33.00	44.00	36.50	30.50	33100.00	1.00
Hymenopus macrophyllus	Chrysobalaceae	Amazon	SINZO	33.00	44.00	80.00	30.50	33100.00	1.00
Hymenopus miltonii	Chrysobalaceae	Amazon	SINZO	33.00	44.00	10.00	20.00	33100.00	1.00
Hymenopus oblongifolius	Chrysobalaceae	Amazon	SINZO	33.00	44.00	90.00	90.00	33100.00	1.00
Hymenopus prismatocarpus	Chrysobalaceae	Amazon	SINZO	33.00	44.00	20.00	30.00	33100.00	1.00
Hymenopus sothersiae	Chrysobalaceae	Amazon	SINZO	38.00	57.00	34.50	47.50	52400.00	1.00
Ilex conocarpa	Aquifoliaceae	Atlantic forest	ENDO	2.70	3.50	5.40	6.60	2.19	5.00
Ilex sp	Aquifoliaceae	Atlantic forest	ENDO	2.70	3.50	7.00	8.80	2.19	5.00
Ilex theezans	Aquifoliaceae	Atlantic forest	ENDO	2.70	3.50	8.60	11.00	2.19	5.00
Inga alba	Fabaceae	Amazon	ENDO	16.00	19.79	18.00	15.00	153.46	15.00

Inga auristellae	Fabaceae	Amazon	ENDO	7.50	14.00	20.00	71.99	282.50	10.00
Inga bicoloriflora	Fabaceae	Amazon	ENDO	7.50	14.00	20.00	115.75	282.50	10.00
Inga brachyrhachis	Fabaceae	Amazon	ENDO	7.50	14.50	20.00	115.75	282.50	10.00
Inga brachystachys	Fabaceae	Amazon	ENDO	8.00	14.00	20.00	126.18	282.50	10.00
Inga capitata	Fabaceae	Atlantic forest	ENDO	5.00	16.00	20.00	91.15	282.50	12.50
Inga cayennensis	Fabaceae	Amazon	ENDO	7.50	14.00	20.00	220.80	282.50	10.00
Inga chartacea	Fabaceae	Amazon	ENDO	10.00	15.00	20.00	100.35	120.00	10.00
Inga chrysantha	Fabaceae	Amazon	ENDO	7.50	14.00	32.50	115.75	282.50	10.00
Inga cordatoalata	Fabaceae	Amazon	ENDO	8.00	11.00	20.00	75.45	282.50	10.00
Inga cylindrica	Fabaceae	Amazon	ENDO	5.70	6.84	15.29	60.29	282.50	20.00
Inga disticha	Fabaceae	Amazon	ENDO	7.50	14.00	20.00	150.00	282.50	10.00
Inga edulis	Fabaceae	Amazon	ENDO	5.84	21.30	8.23	405.00	440.44	7.50
Inga gracilifolia	Fabaceae	Amazon	ENDO	7.50	10.50	20.00	91.07	282.50	10.00
Inga grandiflora	Fabaceae	Amazon	ENDO	7.50	14.00	20.00	103.32	282.50	10.00
Inga heterophylla	Fabaceae	Amazon	ENDO	10.00	14.00	20.00	83.95	282.50	10.00
Inga huberi	Fabaceae	Amazon	ENDO	7.50	14.00	20.00	115.75	282.50	10.00
Inga ingoides	Fabaceae	Amazon	ENDO	10.00	20.00	17.00	81.50	282.50	10.00
Inga lanceifolia	Fabaceae	Atlantic forest	ENDO	5.00	8.50	20.00	164.19	282.50	10.00
Inga lateriflora	Fabaceae	Amazon	ENDO	7.00	10.00	14.00	115.75	282.50	10.00
Inga laurina	Fabaceae	Caatinga	ENDO	10.00	22.00	22.00	130.00	282.50	10.00
Inga leiocalycina	Fabaceae	Amazon	ENDO	8.00	15.00	20.00	219.72	383.58	10.00
Inga longiflora	Fabaceae	Amazon	ENDO	7.50	14.00	20.00	208.08	282.50	10.00
Inga longipes	Fabaceae	Amazon	ENDO	7.50	14.00	20.00	115.75	282.50	10.00
Inga macrophylla	Fabaceae	Amazon	ENDO	7.50	14.00	44.50	311.50	1500.00	10.00
Inga marginata	Fabaceae	Amazon	ENDO	9.00	11.00	12.79	59.02	244.90	9.50
Inga melinonis	Fabaceae	Amazon	ENDO	7.50	14.00	20.00	115.75	282.50	10.00
Inga microcalyx	Fabaceae	Amazon	ENDO	7.50	14.00	20.00	115.75	282.50	10.00

Inga obidensis	Fabaceae	Amazon	ENDO	7.50	12.50	20.00	76.54	282.50	10.00
Inga panurensis	Fabaceae	Amazon	ENDO	7.50	14.00	25.00	123.30	282.50	10.00
Inga paraensis	Fabaceae	Amazon	ENDO	7.00	10.00	20.00	221.49	282.50	10.00
Inga pezizifera	Fabaceae	Amazon	ENDO	8.75	17.25	26.60	167.15	730.00	10.00
Inga pilosula	Fabaceae	Amazon	ENDO	10.00	20.00	20.00	115.75	282.50	10.00
Inga punctata	Fabaceae	Amazon	ENDO	6.50	14.00	15.10	115.75	333.50	10.00
Inga rhynchocalyx	Fabaceae	Amazon	ENDO	7.00	15.00	20.00	115.75	282.50	10.00
Inga rubiginosa	Fabaceae	Amazon	ENDO	2.00	3.00	20.00	115.75	282.50	10.00
Inga sp	Fabaceae	Amazon	ENDO	7.50	14.00	20.00	115.75	282.50	10.00
Inga stipularis	Fabaceae	Amazon	ENDO	7.50	12.50	20.00	148.70	282.50	10.00
Inga suberosa	Fabaceae	Amazon	ENDO	7.50	14.00	20.00	115.75	282.50	10.00
Inga thibaudiana	Fabaceae	Atlantic forest	ENDO	4.28	5.90	26.00	13.00	149.32	14.00
Inga umbellifera	Fabaceae	Amazon	ENDO	7.50	17.50	21.30	94.82	328.17	10.00
Inga umbratica	Fabaceae	Amazon	ENDO	7.00	13.00	25.00	122.39	282.50	10.00
Inga vera	Fabaceae	Caatinga	ENDO	10.00	12.02	25.00	68.00	320.00	7.00
Iriartea deltoidea	Arecaceae	Amazon	ENDO	12.16	12.16	25.73	26.66	1672.85	1.00
Iryanthera coriacea	Myristicaceae	Amazon	ENDO	8.00	18.00	19.56	17.50	1525.00	1.00
Iryanthera elliptica	Myristicaceae	Amazon	ENDO	4.00	15.00	19.91	28.55	500.00	1.00
Iryanthera inpae	Myristicaceae	Amazon	ENDO	13.00	13.50	22.00	15.00	1525.00	1.00
Iryanthera juruensis	Myristicaceae	Amazon	ENDO	9.00	13.00	16.46	24.29	2248.52	1.00
Iryanthera laevis	Myristicaceae	Amazon	ENDO	11.00	11.00	20.30	27.67	2750.55	1.00
Iryanthera lancifolia	Myristicaceae	Amazon	ENDO	32.00	23.00	19.56	34.00	1525.00	1.00
Iryanthera paradoxa	Myristicaceae	Amazon	ENDO	23.50	14.50	27.00	25.50	1525.00	1.00
Iryanthera paraensis	Myristicaceae	Amazon	ENDO	22.00	8.00	24.00	17.00	1525.00	1.00
Iryanthera polyneura	Myristicaceae	Amazon	ENDO	25.00	13.00	19.56	25.50	1525.00	1.00
Iryanthera sagotiana	Myristicaceae	Amazon	ENDO	22.20	13.50	14.00	24.00	2500.00	1.00
Iryanthera sp	Myristicaceae	Amazon	ENDO	13.00	13.50	19.56	25.50	1525.00	1.00

Iryanthera tricornis	Myristicaceae	Amazon	ENDO	14.00	7.00	19.56	27.98	1525.00	1.00
Iryanthera ulei	Myristicaceae	Amazon	ENDO	10.00	19.00	13.10	18.49	1450.00	1.00
Ixora brevifolia	Rubiaceae	Atlantic forest	ENDO	2.75	5.70	7.28	9.03	30.30	2.00
Ixora intensa	Rubiaceae	Amazon	ENDO	2.75	5.30	5.86	8.06	33.07	1.50
Ixora peruviana	Rubiaceae	Amazon	ENDO	2.75	5.25	5.86	6.29	33.09	1.50
Ixora ulei	Rubiaceae	Amazon	ENDO	2.75	5.30	5.86	8.06	33.07	1.50
Jacaranda brasiliana	Bignoniaceae	Cerrado	ANEMO	9.62	18.11	69.22	95.41	5.00	306.00
Jacaranda copaia	Bignoniaceae	Amazon	ANEMO	8.17	8.50	55.00	80.81	5.00	306.00
Jacaranda macrantha	Bignoniaceae	Atlantic forest	ANEMO	10.00	10.00	50.00	80.81	5.00	306.00
Jacaranda montana	Bignoniaceae	Atlantic forest	ANEMO	10.00	17.50	32.50	52.50	5.00	306.00
Jacaranda obtusifolia	Bignoniaceae	Amazon	ANEMO	5.85	5.95	55.00	80.81	7.50	306.00
Jacaranda sp	Bignoniaceae	Amazon	ANEMO	8.17	8.50	55.00	80.81	5.00	306.00
Jacaratia spinosa	Caricaceae	Amazon	ENDO	4.09	6.55	42.00	68.00	64.25	50.00
Joannesia princeps	Euphorbiaceae	Atlantic forest	SINZO	24.15	25.00	90.77	75.70	5000.00	2.00
Kielmeyera coriacea	Calophyllaceae	Cerrado	ANEMO	13.68	30.00	31.72	110.03	110.00	43.08
Kielmeyera lathrophyton	Calophyllaceae	Cerrado	ANEMO	19.69	50.96	40.57	94.01	34.48	59.54
Kielmeyera rubriflora	Calophyllaceae	Cerrado	ANEMO	7.67	16.33	36.15	102.02	76.00	59.54
Kielmeyera sp	Calophyllaceae	Atlantic forest	ANEMO	13.68	30.00	36.15	102.02	76.00	59.54
Kielmeyera speciosa	Calophyllaceae	Cerrado	ANEMO	13.68	30.00	36.15	102.02	76.00	76.00
Lacistema aggregatum	Lacistemataceae	Amazon	ENDO	5.00	5.50	3.29	6.24	30.00	1.00
Lacistema grandifolium	Lacistemataceae	Amazon	ENDO	4.25	5.00	4.49	6.08	30.15	1.00
Lacistema hasslerianum	Lacistemataceae	Amazon	ENDO	4.25	6.20	5.00	8.00	36.85	1.00
Lacistema pubescens	Lacistemataceae	Amazon	ENDO	4.25	6.00	4.63	6.24	30.15	1.00
Lacmellea aculeata	Apocyaceae	Amazon	ENDO	6.00	13.00	8.50	13.61	95.00	1.00
Lacmellea arborescens	Apocyaceae	Amazon	ENDO	6.00	8.00	8.50	13.70	95.00	1.00
Lacunaria crenata	Quiiceae	Amazon	ENDO	7.00	3.70	57.29	56.09	180.00	19.00
Lacunaria jenmanii	Quiiceae	Amazon	ENDO	7.00	9.00	26.28	29.69	180.00	19.00

Lacunaria macrostachya	Quiiceae	Amazon	ENDO	6.50	8.50	37.51	26.50	180.00	19.00
Lacunaria sp	Quiiceae	Amazon	ENDO	7.00	8.25	37.51	29.69	180.00	19.00
Laetia procera	Salicaceae	Amazon	ENDO	2.00	3.25	9.00	9.00	3.66	40.00
Lafoensia pacari	Lythraceae	Cerrado	ANEMO	8.00	22.60	32.28	53.13	26.03	100.50
Lafoensia sp	Lythraceae	Amazon	ANEMO	8.00	22.60	32.28	53.13	26.03	100.50
Lamanonia ternata	Cunoniaceae	Atlantic forest	ANEMO	10.80	45.00	3.00	11.34	0.67	38.00
Lecythis chartacea	Lecythidaceae	Amazon	SINZO	14.00	24.50	40.00	45.00	2940.00	2.00
Lecythis confertiflora	Lecythidaceae	Amazon	SINZO	27.50	35.86	31.25	46.25	1184.69	2.00
Lecythis corrugata	Lecythidaceae	Amazon	SINZO	27.50	35.86	33.50	26.25	1240.00	2.00
Lecythis gracieana	Lecythidaceae	Amazon	SINZO	27.50	35.86	25.00	25.00	4692.97	1.75
Lecythis holcogyne	Lecythidaceae	Amazon	SINZO	20.00	35.00	57.50	60.00	2990.00	2.00
Lecythis idatimon	Lecythidaceae	Amazon	SINZO	27.50	35.86	35.00	42.50	2990.00	2.00
Lecythis lurida	Lecythidaceae	Atlantic forest	SINZO	33.75	34.58	90.00	75.00	24154.18	4.50
Lecythis parvifructa	Lecythidaceae	Amazon	SINZO	27.50	27.50	42.50	33.75	4692.97	2.00
Lecythis pisonis	Lecythidaceae	Amazon	SINZO	28.75	46.93	56.25	61.03	5176.89	20.00
Lecythis poiteaui	Lecythidaceae	Amazon	SINZO	27.50	35.86	78.75	45.00	2990.00	2.00
Lecythis prancei	Lecythidaceae	Amazon	SINZO	50.00	55.00	111.25	76.25	35360.48	1.50
Lecythis retusa	Lecythidaceae	Amazon	SINZO	27.50	35.86	60.00	50.00	2990.00	2.00
Lecythis sp	Lecythidaceae	Amazon	SINZO	27.50	35.86	55.00	47.50	2990.00	2.00
Lecythis zabucajo	Lecythidaceae	Amazon	SINZO	12.50	30.00	106.25	90.00	1713.26	2.00
Leonia cymosa	Violaceae	Amazon	ENDO	10.00	12.75	36.16	23.26	463.50	7.00
Leonia glycycarpa	Violaceae	Amazon	ENDO	10.00	12.75	36.16	38.18	463.50	7.00
Leptobalanus apetalus	Chrysobalaceae	Amazon	SINZO	14.00	15.00	22.50	23.75	4166.67	1.00
Leptobalanus emarginatus	Chrysobalaceae	Amazon	SINZO	14.15	19.06	20.00	23.13	4166.67	1.00
Leptobalanus humilis	Chrysobalaceae	Amazon	SINZO	14.30	23.83	16.50	22.50	4166.67	1.00
Leptobalanus latus	Chrysobalaceae	Amazon	SINZO	14.15	19.06	25.00	23.13	4166.67	1.00
Leptobalanus longistylus	Chrysobalaceae	Amazon	SINZO	14.15	19.06	30.00	23.13	4166.67	1.00

Leptobalanus octandrus	Chrysobalaceae	Atlantic forest	SINZO	14.15	19.06	21.25	25.00	4166.67	1.00
Leptolobium dasycarpum	Fabaceae	Cerrado	ANEMO	5.00	4.88	11.00	35.50	43.10	2.00
Leucochloron incuriale	Fabaceae	Atlantic forest	ANEMO	1.70	1.60	26.80	130.23	78.74	14.00
Leucochloron limae	Fabaceae	Caatinga	ANEMO	10.50	10.50	26.80	130.23	78.74	14.00
Licania blackii	Chrysobalaceae	Amazon	SINZO	11.00	16.50	17.70	26.50	1200.00	1.00
Licania bracteata	Chrysobalaceae	Amazon	SINZO	11.00	16.50	40.00	70.00	1200.00	1.00
Licania canescens	Chrysobalaceae	Amazon	SINZO	15.00	26.00	15.50	26.00	1500.00	1.00
Licania cidii	Chrysobalaceae	Amazon	SINZO	11.00	16.50	17.70	26.50	1200.00	1.00
Licania coriacea	Chrysobalaceae	Amazon	SINZO	11.00	16.50	17.70	27.50	1200.00	1.00
Licania discolor	Chrysobalaceae	Amazon	SINZO	11.00	16.50	17.70	26.50	1200.00	1.00
Licania gracilipes	Chrysobalaceae	Amazon	SINZO	11.00	16.50	17.70	18.00	1200.00	1.00
Licania hoehnei	Chrysobalaceae	Atlantic forest	SINZO	11.00	16.50	34.00	49.00	1200.00	1.00
Licania hypoleuca	Chrysobalaceae	Amazon	SINZO	11.00	16.50	14.95	17.50	84.70	1.00
Licania impressa	Chrysobalaceae	Amazon	SINZO	13.00	18.00	24.00	26.00	1800.00	1.00
Licania kunthiana	Chrysobalaceae	Atlantic forest	SINZO	10.00	16.50	10.00	20.00	300.00	1.00
Licania laxiflora	Chrysobalaceae	Amazon	SINZO	11.00	16.50	17.70	90.00	1200.00	1.00
Licania membranacea	Chrysobalaceae	Amazon	SINZO	10.00	16.00	20.50	25.00	4000.00	1.00
Licania micrantha	Chrysobalaceae	Amazon	SINZO	9.00	16.00	17.70	46.25	442.73	1.00
Licania niloi	Chrysobalaceae	Amazon	SINZO	9.00	18.00	18.00	27.00	1000.00	1.00
Licania pallida	Chrysobalaceae	Amazon	SINZO	12.00	14.00	12.00	18.00	6000.00	1.00
Licania rodriguesii	Chrysobalaceae	Amazon	SINZO	11.00	16.50	17.70	26.50	1200.00	1.00
Licania sandwithii	Chrysobalaceae	Amazon	SINZO	11.00	16.50	17.70	26.50	1200.00	1.00
Licania sp	Chrysobalaceae	Atlantic forest	SINZO	11.00	16.50	17.70	26.50	1920.00	1.00
Licania sprucei	Chrysobalaceae	Amazon	SINZO	11.00	16.50	17.70	26.50	1200.00	1.00
Licania triandra	Chrysobalaceae	Amazon	SINZO	11.00	16.50	17.70	35.00	1200.00	1.00
Licaria armeniaca	Lauraceae	Atlantic forest	ENDO	13.00	15.00	14.00	15.00	1290.00	1.00
Licaria brasiliensis	Lauraceae	Amazon	ENDO	10.15	15.00	14.00	24.25	1290.00	1.00

Licaria crassifolia	Lauraceae	Amazon	ENDO	10.15	31.76	14.00	46.09	1290.00	1.00
Licaria guianensis	Lauraceae	Amazon	ENDO	7.29	15.00	16.00	20.20	1290.00	1.00
Licaria macrophylla	Lauraceae	Amazon	ENDO	10.15	15.00	14.00	24.25	1290.00	1.00
Licaria martiniana	Lauraceae	Amazon	ENDO	10.15	15.00	11.00	24.25	1290.00	1.00
Licaria oppositifolia	Lauraceae	Amazon	ENDO	10.15	15.00	14.00	24.25	1290.00	1.00
Licaria pachycarpa	Lauraceae	Amazon	ENDO	10.15	15.00	14.00	24.25	1290.00	1.00
Licaria rodriguesii	Lauraceae	Amazon	ENDO	10.15	15.00	14.00	24.25	1290.00	1.00
Licaria sp	Lauraceae	Amazon	ENDO	10.15	15.00	14.00	24.25	1290.00	1.00
Luehea candicans	Malvaceae	Caatinga	ANEMO	5.00	12.80	13.17	30.83	5.81	10.00
Luehea divaricata	Malvaceae	Atlantic forest	ANEMO	3.53	7.89	10.00	19.76	4.22	10.00
Luehea grandiflora	Malvaceae	Atlantic forest	ANEMO	4.50	12.40	16.86	36.99	5.02	10.00
Luehea sp	Malvaceae	Atlantic forest	ANEMO	4.30	11.30	10.00	26.67	5.02	10.00
Mabea angularis	Euphorbiaceae	Amazon	SINZO	10.00	8.00	11.00	10.00	90.00	3.00
Mabea fistulifera	Euphorbiaceae	Atlantic forest	SINZO	10.00	7.53	11.00	13.00	92.50	3.00
Mabea piriri	Euphorbiaceae	Atlantic forest	ENDO	10.00	11.50	13.00	18.00	102.70	3.00
Mabea sp	Euphorbiaceae	Amazon	SINZO	10.00	8.00	11.00	10.00	90.00	3.00
Mabea speciosa	Euphorbiaceae	Amazon	SINZO	10.00	8.00	11.00	11.25	90.00	3.00
Mabea speciosa subsp. speciosa	Euphorbiaceae	Amazon	SINZO	10.00	8.00	11.00	10.00	90.00	3.00
Mabea subsessilis	Euphorbiaceae	Amazon	SINZO	10.00	8.00	11.00	10.00	90.00	3.00
Mabea uleana	Euphorbiaceae	Amazon	SINZO	10.00	8.00	11.00	10.00	90.00	3.00
Machaerium acutifolium	Fabaceae	Caatinga	ANEMO	8.00	11.00	18.00	52.00	345.24	1.00
Machaerium floridum	Fabaceae	Caatinga	ANEMO	18.27	57.16	17.00	62.00	345.24	1.00
Machaerium hirtum	Fabaceae	Cerrado	ANEMO	8.00	12.00	6.78	2.99	345.24	1.00
Machaerium leucopterum	Fabaceae	Caatinga	ANEMO	8.00	13.00	17.00	62.00	345.24	1.00
Machaerium myrianthum	Fabaceae	Amazon	ANEMO	8.00	13.00	17.00	62.00	345.24	1.00
Machaerium nyctitans	Fabaceae	Atlantic forest	ANEMO	6.00	16.00	18.00	47.00	192.31	1.00
Machaerium opacum	Fabaceae	Cerrado	ANEMO	8.00	14.00	11.00	64.00	345.24	1.00

Machaerium sp	Fabaceae	Amazon	ANEMO	8.00	13.00	17.00	62.00	345.24	1.00
Machaerium stipitatum	Fabaceae	Atlantic forest	ANEMO	7.00	12.00	12.00	58.00	345.24	1.00
Machaerium villosum	Fabaceae	Atlantic forest	ANEMO	8.00	13.00	17.00	62.00	373.23	1.00
Magnolia ovata	Magnoliaceae	Atlantic forest	ENDO	5.71	10.20	2.93	11.32	198.18	50.00
Manilkara bidentata	Sapotaceae	Amazon	ENDO	12.00	19.00	21.50	22.65	1300.00	1.00
Manilkara cavalcantei	Sapotaceae	Amazon	ENDO	6.00	22.00	21.07	16.03	781.58	1.00
Manilkara elata	Sapotaceae	Amazon	ENDO	13.00	23.00	20.65	24.20	781.58	1.00
Manilkara inundata	Sapotaceae	Amazon	ENDO	6.00	13.00	12.00	15.00	781.58	1.00
Manilkara salzmannii	Sapotaceae	Caatinga	ENDO	7.00	14.00	29.96	23.67	263.16	2.00
Manilkara sp	Sapotaceae	Amazon	ENDO	11.00	22.50	21.07	22.65	781.58	1.00
Maprounea guianensis	Euphorbiaceae	Caatinga	ENDO	2.77	3.46	4.17	4.34	125.00	2.00
Maquira calophylla	Moraceae	Amazon	ENDO	10.00	23.00	8.13	25.04	450.00	2.50
Maquira coriacea	Moraceae	Amazon	ENDO	10.00	10.50	8.13	17.26	430.00	3.00
Maquira guianensis	Moraceae	Amazon	ENDO	10.00	17.50	8.13	10.83	211.05	2.50
Maquira sclerophylla	Moraceae	Amazon	ENDO	15.95	13.42	8.13	17.26	3518.65	2.00
Maquira sp	Moraceae	Amazon	ENDO	10.00	11.00	8.13	17.26	450.00	2.50
Matayba arborescens	Sapindaceae	Amazon	ENDO	6.00	11.00	17.70	15.40	205.00	1.50
Matayba elegans	Sapindaceae	Amazon	ENDO	6.50	10.00	18.00	27.45	205.00	1.50
Matayba guianensis	Sapindaceae	Atlantic forest	ENDO	8.26	10.11	18.45	19.11	205.00	3.00
Matayba juglandifolia	Sapindaceae	Atlantic forest	ENDO	6.00	9.00	17.40	13.05	205.00	1.50
Matayba sp	Sapindaceae	Amazon	ENDO	6.00	10.06	17.70	19.33	205.00	1.50
Matisia bicolor	Malvaceae	Amazon	ENDO	11.13	19.39	110.00	50.74	2220.00	5.00
Matisia cordata	Malvaceae	Amazon	ENDO	15.14	30.68	110.00	115.00	2220.00	5.00
Matisia ochrocalyx	Malvaceae	Amazon	ENDO	9.16	16.89	110.00	48.94	2220.00	5.00
Meliosma sellowii	Sabiaceae	Atlantic forest	ENDO	11.60	15.00	18.00	20.00	586.33	1.00
Mezilaurus duckei	Lauraceae	Amazon	ENDO	13.00	18.00	7.96	13.03	1080.00	1.00
Mezilaurus itauba	Lauraceae	Amazon	ENDO	13.00	18.00	7.96	13.03	1080.00	1.00

Mezilaurus lindaviana	Lauraceae	Amazon	ENDO	13.00	18.00	7.96	13.03	1080.00	1.00
Mezilaurus sp	Lauraceae	Amazon	ENDO	13.00	18.00	7.96	13.03	1080.00	1.00
Mezilaurus subcordata	Lauraceae	Amazon	ENDO	13.00	18.00	7.96	13.03	1080.00	1.00
Mezilaurus synandra	Lauraceae	Amazon	ENDO	13.00	18.00	7.96	13.03	1080.00	1.00
Miconia affinis	Melastomataceae	Amazon	ENDO	1.00	1.00	4.50	3.00	0.20	23.75
Miconia albicans	Melastomataceae	Cerrado	ENDO	0.95	1.07	6.08	5.80	1.04	30.00
Miconia argyrophylla	Melastomataceae	Amazon	ENDO	1.00	1.20	5.40	4.60	0.52	23.75
Miconia atlantica	Melastomataceae	Atlantic forest	ENDO	2.40	1.20	4.25	4.01	0.45	23.75
Miconia brasiliensis	Melastomataceae	Atlantic forest	ENDO	1.00	1.20	3.00	2.60	8.05	6.00
Miconia burchellii	Melastomataceae	Cerrado	ENDO	0.54	0.82	4.33	4.89	0.22	32.00
Miconia cabussu	Melastomataceae	Atlantic forest	ENDO	1.00	1.20	4.50	4.01	1.25	23.75
Miconia chrysophylla	Melastomataceae	Amazon	ENDO	1.73	2.48	2.73	4.01	0.45	23.75
Miconia dispar	Melastomataceae	Amazon	ENDO	0.63	1.04	4.50	2.99	0.45	23.75
Miconia dodecandra	Melastomataceae	Atlantic forest	ENDO	0.54	1.08	4.95	4.01	0.45	85.00
Miconia eriodonta	Melastomataceae	Amazon	ENDO	1.00	1.20	4.50	6.33	0.45	23.75
Miconia ferruginata	Melastomataceae	Cerrado	ENDO	1.00	1.50	6.66	8.70	0.50	45.00
Miconia flammea	Melastomataceae	Atlantic forest	ENDO	3.11	3.44	5.00	4.01	0.45	23.75
Miconia formosa	Melastomataceae	Atlantic forest	ENDO	1.00	1.20	4.50	32.42	2.82	23.75
Miconia holosericea	Melastomataceae	Amazon	ENDO	0.95	1.40	5.40	6.50	0.45	23.75
Miconia lepidota	Melastomataceae	Amazon	ENDO	0.71	1.20	4.50	4.01	0.45	15.00
Miconia leucocarpa	Melastomataceae	Cerrado	ENDO	1.00	1.20	7.50	8.00	0.50	17.50
Miconia longifolia	Melastomataceae	Amazon	ENDO	1.15	1.38	4.50	3.15	0.50	23.75
Miconia longispicata	Melastomataceae	Amazon	ENDO	0.99	1.26	4.50	6.04	0.45	23.75
Miconia lourteigiana	Melastomataceae	Amazon	ENDO	1.00	1.20	4.50	3.14	0.45	23.75
Miconia myriantha	Melastomataceae	Amazon	ENDO	1.00	1.20	4.50	2.55	0.45	23.75
Miconia petropolitana	Melastomataceae	Atlantic forest	ENDO	1.00	1.20	4.50	2.04	0.45	23.75
Miconia phanerostila	Melastomataceae	Amazon	ENDO	1.50	2.00	3.17	3.17	0.40	23.75

Miconia poeppigii	Melastomataceae	Amazon	ENDO	0.55	1.09	4.50	3.18	0.45	23.75
Miconia pubipetala	Melastomataceae	Amazon	ENDO	0.86	1.20	4.50	4.07	0.45	23.75
Miconia punctata	Melastomataceae	Amazon	ENDO	1.64	2.75	4.50	4.10	0.45	23.75
Miconia pyrifolia	Melastomataceae	Amazon	ENDO	1.00	1.20	7.50	5.00	0.45	23.75
Miconia ruficalyx	Melastomataceae	Amazon	ENDO	1.00	1.20	6.00	6.10	0.45	23.75
Miconia sellowiana	Melastomataceae	Atlantic forest	ENDO	1.00	1.70	3.20	3.65	0.50	7.50
Miconia sp	Melastomataceae	Cerrado	ENDO	1.00	1.20	4.50	4.01	0.45	23.75
Miconia splendens	Melastomataceae	Amazon	ENDO	0.59	0.60	3.02	3.18	0.45	23.75
Miconia tomentosa	Melastomataceae	Amazon	ENDO	0.56	1.14	6.20	7.30	0.45	23.75
Miconia valtheri	Melastomataceae	Atlantic forest	ENDO	0.91	1.13	3.90	4.40	0.45	23.75
Miconia willdenowii	Melastomataceae	Atlantic forest	ENDO	2.53	3.69	4.50	3.91	0.45	23.75
Micropholis acutangula	Sapotaceae	Amazon	ENDO	7.50	15.00	19.63	47.04	190.82	2.00
Micropholis casiquiarensis	Sapotaceae	Amazon	ENDO	10.50	19.00	14.02	25.25	377.94	2.00
Micropholis caudata	Sapotaceae	Amazon	ENDO	7.25	20.00	19.50	22.53	258.16	1.00
Micropholis crassipedicellata	Sapotaceae	Atlantic forest	ENDO	8.50	14.70	18.00	24.00	200.00	1.00
Micropholis cylindrocarpa	Sapotaceae	Amazon	ENDO	9.00	21.00	14.50	22.53	208.70	1.00
Micropholis egensis	Sapotaceae	Amazon	ENDO	9.50	14.70	19.38	29.80	288.39	1.00
Micropholis gardneriana	Sapotaceae	Atlantic forest	ENDO	6.92	10.00	11.20	12.40	258.16	1.00
Micropholis guyanensis	Sapotaceae	Amazon	ENDO	5.00	9.00	12.00	16.50	258.16	1.00
Micropholis madeirensis	Sapotaceae	Amazon	ENDO	7.25	14.70	15.00	22.53	258.16	1.00
Micropholis mensalis	Sapotaceae	Amazon	ENDO	7.25	14.70	14.02	21.94	258.16	2.00
Micropholis sp	Sapotaceae	Amazon	ENDO	7.25	14.70	14.02	22.53	258.16	1.00
Micropholis splendens	Sapotaceae	Amazon	ENDO	7.25	22.00	14.02	15.79	258.16	1.00
Micropholis trunciflora	Sapotaceae	Amazon	ENDO	6.50	14.00	12.44	24.16	407.47	1.00
Micropholis venulosa	Sapotaceae	Atlantic forest	ENDO	4.85	10.70	14.42	15.98	360.00	1.00
Micropholis williamii	Sapotaceae	Amazon	ENDO	7.00	14.00	12.10	21.79	227.71	1.00
Minquartia guianensis	Olacaceae	Amazon	ENDO	10.00	18.00	12.70	26.20	1400.00	1.00

Mollinedia argyrogyna	Monimiaceae	Atlantic forest	ENDO	9.00	13.60	6.00	3.00	139.55	15.50
Mollinedia blumenaviana	Monimiaceae	Atlantic forest	ENDO	9.00	13.60	6.30	7.80	139.55	15.50
Mollinedia elegans	Monimiaceae	Atlantic forest	ENDO	9.00	13.60	5.00	6.80	54.19	15.50
Mollinedia engleriana	Monimiaceae	Atlantic forest	ENDO	9.00	13.60	8.80	12.70	139.55	15.50
Mollinedia gilgiana	Monimiaceae	Atlantic forest	ENDO	9.00	13.60	9.93	7.80	139.55	15.50
Mollinedia puberula	Monimiaceae	Atlantic forest	ENDO	9.00	13.60	9.01	9.25	139.55	15.50
Mollinedia salicifolia	Monimiaceae	Atlantic forest	ENDO	9.00	13.60	12.00	15.40	139.55	15.50
Mollinedia schottiana	Monimiaceae	Atlantic forest	ENDO	5.90	13.60	6.40	12.30	170.00	15.50
Mollinedia sp	Monimiaceae	Atlantic forest	ENDO	9.00	13.60	9.01	7.80	139.55	15.50
Mollinedia triflora	Monimiaceae	Atlantic forest	ENDO	9.00	13.60	9.01	7.71	139.55	15.50
Mollinedia widgrenii	Monimiaceae	Atlantic forest	ENDO	10.00	13.60	10.00	11.00	139.55	15.50
Monteverdia evonymoides	Celastraceae	Atlantic forest	ENDO	28.00	35.50	6.94	5.00	166.12	3.00
Monteverdia gonoclada	Celastraceae	Atlantic forest	ENDO	4.50	8.00	6.94	11.44	166.12	3.00
Monteverdia guyanensis	Celastraceae	Amazon	ENDO	16.25	47.90	6.94	18.58	166.12	3.00
Monteverdia ilicifolia	Celastraceae	Atlantic forest	ENDO	16.25	21.75	6.94	7.92	166.12	3.00
Moquilea cariae	Celastraceae	Amazon	SINZO	38.00	40.50	42.00	59.50	11900.00	1.00
Moquilea egleri	Chrysobalaceae	Amazon	SINZO	38.00	40.50	42.00	45.00	11900.00	1.00
Moquilea fritschii	Chrysobalaceae	Amazon	SINZO	38.00	40.50	90.00	110.00	11900.00	1.00
Moquilea tomentosa	Chrysobalaceae	Amazon	SINZO	38.00	40.50	42.00	59.50	9550.00	1.00
Moquilea unguiculata	Chrysobalaceae	Amazon	SINZO	38.00	61.00	42.00	74.00	45700.00	1.00
Mouriri angulicosta	Melastomataceae	Amazon	ENDO	7.50	6.50	19.25	8.21	202.17	2.25
Mouriri apiranga	Melastomataceae	Amazon	ENDO	8.25	9.20	17.50	18.28	202.17	2.25
Mouriri collocarpa	Melastomataceae	Amazon	ENDO	20.00	16.00	19.25	31.12	202.17	2.00
Mouriri dimorphandra	Melastomataceae	Amazon	ENDO	5.40	6.45	12.00	9.25	202.17	2.25
Mouriri duckeana	Melastomataceae	Amazon	ENDO	10.50	9.00	12.00	10.50	202.17	2.25
Mouriri duckeanoides	Melastomataceae	Amazon	ENDO	8.00	8.00	19.25	12.50	202.17	1.00
Mouriri elliptica	Melastomataceae	Cerrado	ENDO	7.00	12.00	22.00	25.00	725.09	5.00

Mouriri ficoides	Melastomataceae	Amazon	ENDO	16.00	19.50	22.50	23.61	202.17	5.00
Mouriri grandiflora	Melastomataceae	Amazon	ENDO	8.50	8.50	20.00	24.39	202.17	2.25
Mouriri guianensis	Melastomataceae	Amazon	ENDO	7.00	11.00	25.00	25.00	163.00	1.50
Mouriri lunatanthera	Melastomataceae	Amazon	ENDO	6.95	9.40	19.25	16.49	202.17	2.25
Mouriri nigra	Melastomataceae	Amazon	ENDO	10.50	8.00	19.25	14.58	202.17	2.25
Mouriri pusa	Melastomataceae	Cerrado	ENDO	10.00	11.00	32.00	22.00	208.33	2.50
Mouriri sp	Melastomataceae	Amazon	ENDO	8.25	9.20	19.25	16.49	202.17	2.25
Mouriri torquata	Melastomataceae	Amazon	ENDO	12.20	10.60	13.50	11.75	202.17	2.25
Mouriri vernicosa	Melastomataceae	Amazon	ENDO	11.00	13.50	19.25	15.17	202.17	2.25
Myrceugenia bracteosa	Myrtaceae	Atlantic forest	ENDO	5.80	6.00	5.10	6.80	44.87	8.00
Myrceugenia glaucescens	Myrtaceae	Atlantic forest	ENDO	4.00	6.00	9.50	9.50	44.87	8.00
Myrceugenia miersiana	Myrtaceae	Atlantic forest	ENDO	5.80	7.09	16.00	21.00	41.06	8.00
Myrceugenia myrcioides	Myrtaceae	Atlantic forest	ENDO	8.00	6.00	7.00	1.60	48.68	8.00
Myrcia aliena	Myrtaceae	Amazon	ENDO	4.30	10.50	5.50	4.14	73.00	2.00
Myrcia amazonica	Myrtaceae	Atlantic forest	ENDO	4.51	5.50	8.40	7.09	73.00	2.00
Myrcia bracteata	Myrtaceae	Amazon	ENDO	4.30	10.50	4.80	6.20	73.00	2.00
Myrcia brasiliensis	Myrtaceae	Atlantic forest	ENDO	5.70	5.00	11.00	12.00	44.01	2.00
Myrcia camapuanensis	Myrtaceae	Cerrado	ENDO	4.30	5.00	5.50	7.60	73.00	2.00
Myrcia creba	Myrtaceae	Amazon	ENDO	4.30	5.00	5.50	7.60	73.00	2.00
Myrcia cuspidata	Myrtaceae	Amazon	ENDO	5.50	5.00	5.50	7.60	73.00	2.00
Myrcia diaphana	Myrtaceae	Atlantic forest	ENDO	4.30	5.00	5.50	5.99	73.00	2.00
Myrcia excoriata	Myrtaceae	Atlantic forest	ENDO	4.30	5.00	5.50	7.60	73.00	2.00
Myrcia fenestrata	Myrtaceae	Amazon	ENDO	4.30	5.00	5.50	6.90	73.00	2.00
Myrcia ferruginosa	Myrtaceae	Atlantic forest	ENDO	4.30	5.00	5.50	14.15	73.00	2.00
Myrcia glomerata	Myrtaceae	Atlantic forest	ENDO	4.30	4.05	5.50	7.60	73.00	2.00
Myrcia guianensis	Myrtaceae	Cerrado	ENDO	3.36	4.10	5.32	5.95	56.87	2.00
Myrcia hylobates	Myrtaceae	Amazon	ENDO	4.30	5.00	5.50	7.60	73.00	2.00

Myrcia inaequiloba	Myrtaceae	Amazon	ENDO	4.30	5.00	4.34	4.66	50.00	2.00
Myrcia lasiantha	Myrtaceae	Cerrado	ENDO	4.30	5.00	5.50	7.60	165.97	2.00
Myrcia minutiflora	Myrtaceae	Amazon	ENDO	4.30	5.00	5.50	15.59	73.00	2.00
Myrcia multiflora	Myrtaceae	Cerrado	ENDO	3.70	6.40	5.60	5.50	17.62	2.00
Myrcia myrtillifolia	Myrtaceae	Cerrado	ENDO	4.30	5.00	5.50	7.60	73.00	2.00
Myrcia neoclusiifolia	Myrtaceae	Atlantic forest	ENDO	4.30	5.00	5.50	7.60	72.99	2.00
Myrcia neolucida	Myrtaceae	Atlantic forest	ENDO	4.30	5.00	5.50	77.70	73.00	2.00
Myrcia neoobscura	Myrtaceae	Atlantic forest	ENDO	4.30	5.00	5.50	7.60	200.00	2.00
Myrcia neospeciosa	Myrtaceae	Amazon	ENDO	4.30	5.00	5.50	7.60	73.00	2.00
Myrcia neosuaveolens	Myrtaceae	Atlantic forest	ENDO	4.30	5.00	5.50	7.60	73.00	2.00
Myrcia paivae	Myrtaceae	Amazon	ENDO	4.30	5.00	4.76	5.72	258.16	2.00
Myrcia racemosa	Myrtaceae	Atlantic forest	ENDO	6.00	5.00	13.40	20.00	59.80	2.00
Myrcia servata	Myrtaceae	Amazon	ENDO	4.30	5.00	5.50	9.37	73.00	2.00
Myrcia sp	Myrtaceae	Cerrado	ENDO	4.30	5.00	5.50	7.60	73.00	2.00
Myrcia spectabilis	Myrtaceae	Atlantic forest	ENDO	11.40	23.81	14.70	13.00	377.94	1.00
Myrcia splendens	Myrtaceae	Cerrado	ENDO	3.93	6.00	5.64	9.53	99.21	2.00
Myrcia strigipes	Myrtaceae	Atlantic forest	ENDO	4.30	10.00	5.50	12.69	73.00	2.00
Myrcia strigosa	Myrtaceae	Atlantic forest	ENDO	4.30	5.00	5.50	7.60	380.00	2.00
Myrcia subcordata	Myrtaceae	Atlantic forest	ENDO	4.30	5.00	5.50	6.22	73.00	2.00
Myrcia sylvatica	Myrtaceae	Amazon	ENDO	4.00	7.00	7.80	6.55	73.00	2.00
Myrcia tomentosa	Myrtaceae	Caatinga	ENDO	3.54	4.38	5.08	5.62	73.00	3.00
Myrcia umbraticola	Myrtaceae	Amazon	ENDO	4.30	5.00	5.50	13.01	73.00	2.00
Myrcia vellozoi	Myrtaceae	Atlantic forest	ENDO	4.30	5.00	5.50	7.60	692.80	2.00
Myrcia venulosa	Myrtaceae	Atlantic forest	ENDO	4.00	5.00	7.75	10.00	73.00	2.00
Myrciaria floribunda	Myrtaceae	Atlantic forest	ENDO	5.25	6.25	7.25	6.46	60.61	1.00
Myroxylon balsamum	Fabaceae	Amazon	ANEMO	22.51	96.02	15.00	90.00	572.00	1.00
Myroxylon sp	Fabaceae	Amazon	ANEMO	22.51	96.02	15.00	90.00	572.00	1.00

Myrsine gardneriana	Primulaceae	Atlantic forest	ENDO	2.86	2.86	3.42	3.47	12.34	1.00
Myrsine guianensis	Primulaceae	Cerrado	ENDO	4.29	4.25	4.65	4.80	19.50	1.00
Myrsine hermogenesii	Primulaceae	Atlantic forest	ENDO	3.75	3.70	6.50	8.50	21.00	1.00
Myrsine lineata	Primulaceae	Atlantic forest	ENDO	3.75	3.70	4.05	4.50	21.00	1.00
Myrsine sp	Primulaceae	Amazon	ENDO	3.75	3.70	4.05	4.50	21.00	1.00
Myrsine umbellata	Primulaceae	Atlantic forest	ENDO	3.50	3.50	3.80	4.40	30.04	1.00
Naucleopsis caloneura	Moraceae	Amazon	ENDO	13.36	10.00	19.00	20.48	1876.57	8.50
Naucleopsis glabra	Moraceae	Amazon	ENDO	7.00	10.00	27.00	30.00	610.00	8.50
Naucleopsis oblongifolia	Moraceae	Atlantic forest	ENDO	13.36	17.50	26.20	22.40	610.00	8.50
Naucleopsis pseudonaga	Moraceae	Amazon	ENDO	22.26	10.00	27.90	30.00	610.00	8.50
Naucleopsis sp	Moraceae	Amazon	ENDO	13.36	10.00	27.90	30.00	610.00	8.50
Naucleopsis stipularis	Moraceae	Amazon	ENDO	13.36	10.00	27.90	30.00	610.00	8.50
Naucleopsis ternstroemiiflora	Moraceae	Amazon	ENDO	13.36	10.00	27.90	17.89	610.00	8.50
Naucleopsis ulei	Moraceae	Amazon	ENDO	13.36	1.00	32.61	35.59	610.00	8.50
Nectandra amazonum	Lauraceae	Amazon	ENDO	9.00	14.00	10.00	19.00	2016.00	1.00
Nectandra cissiflora	Lauraceae	Atlantic forest	ENDO	7.50	15.65	9.00	14.50	126.60	1.00
Nectandra cuspidata	Lauraceae	Amazon	ENDO	10.00	10.00	7.40	16.00	1116.87	1.00
Nectandra grandiflora	Lauraceae	Atlantic forest	ENDO	10.00	14.00	10.50	13.00	1464.50	1.00
Nectandra nitidula	Lauraceae	Atlantic forest	ENDO	4.50	10.00	6.00	19.00	208.33	1.00
Nectandra oppositifolia	Lauraceae	Atlantic forest	ENDO	10.00	14.00	11.00	15.00	769.23	1.00
Nectandra pulverulenta	Lauraceae	Amazon	ENDO	9.00	14.00	9.50	16.00	1116.87	1.00
Nectandra sp	Lauraceae	Amazon	ENDO	9.00	14.00	9.50	16.00	1116.87	1.00
Neea floribunda	Nyctagiceae	Amazon	ENDO	7.20	11.12	7.00	18.80	89.22	1.00
Neea madeirana	Nyctagiceae	Amazon	ENDO	8.05	11.12	7.00	14.50	105.00	1.00
Neea oppositifolia	Nyctagiceae	Amazon	ENDO	8.05	8.17	7.00	12.60	314.57	1.00
Neea ovalifolia	Nyctagiceae	Amazon	ENDO	8.05	11.12	7.00	11.76	105.00	1.00
Neea parviflora	Nyctagiceae	Amazon	ENDO	8.05	11.12	7.00	15.40	105.00	1.00

Neea sp	Nyctagiceae	Amazon	ENDO	8.05	11.12	7.00	14.50	105.00	1.00
Neea theifera	Nyctagiceae	Cerrado	ENDO	8.13	14.06	6.27	12.70	105.00	1.00
Ocotea aciphylla	Lauraceae	Atlantic forest	ENDO	9.50	17.75	11.98	19.39	3394.40	1.00
Ocotea amazonica	Lauraceae	Amazon	ENDO	8.50	13.45	10.00	12.30	253.97	1.00
Ocotea argyrophylla	Lauraceae	Amazon	ENDO	8.50	13.00	8.00	10.00	253.97	1.00
Ocotea bicolor	Lauraceae	Atlantic forest	ENDO	10.30	10.70	12.10	12.60	69.03	1.00
Ocotea bofo	Lauraceae	Amazon	ENDO	7.00	11.00	10.00	23.84	320.00	1.00
Ocotea brachybotrya	Lauraceae	Atlantic forest	ENDO	8.50	13.00	10.00	13.93	253.97	1.00
Ocotea canaliculata	Lauraceae	Amazon	ENDO	11.00	13.00	12.00	15.67	253.97	1.00
Ocotea catharinensis	Lauraceae	Atlantic forest	ENDO	8.50	15.70	11.00	8.00	83.33	1.00
Ocotea ceanothifolia	Lauraceae	Amazon	ENDO	8.50	13.00	10.00	13.93	253.97	1.00
Ocotea cernua	Lauraceae	Amazon	ENDO	8.50	13.00	12.20	15.00	167.04	1.00
Ocotea cinerea	Lauraceae	Amazon	ENDO	5.91	12.35	8.18	14.22	211.77	1.00
Ocotea corymbosa	Lauraceae	Atlantic forest	ENDO	6.00	8.00	8.00	6.00	253.97	1.00
Ocotea cujumary	Lauraceae	Amazon	ENDO	9.20	17.20	14.10	20.84	868.50	1.00
Ocotea daphnifolia	Lauraceae	Atlantic forest	ENDO	14.00	14.00	15.00	15.00	253.97	1.00
Ocotea delicata	Lauraceae	Amazon	ENDO	8.50	13.00	10.00	17.00	253.97	1.00
Ocotea diospyrifolia	Lauraceae	Atlantic forest	ENDO	10.60	16.00	1.60	16.20	555.56	1.00
Ocotea dispersa	Lauraceae	Atlantic forest	ENDO	7.70	13.00	9.00	14.00	300.00	1.00
Ocotea divaricata	Lauraceae	Atlantic forest	ENDO	8.50	13.00	10.00	13.50	253.97	1.00
Ocotea floribunda	Lauraceae	Amazon	ENDO	9.00	14.00	6.00	6.78	1643.32	1.00
Ocotea glomerata	Lauraceae	Amazon	ENDO	8.50	13.00	5.25	13.93	253.97	1.00
Ocotea guianensis	Lauraceae	Amazon	ENDO	7.29	16.00	6.76	11.88	416.67	1.00
Ocotea immersa	Lauraceae	Amazon	ENDO	8.50	13.00	10.00	13.93	253.97	1.00
Ocotea indecora	Lauraceae	Atlantic forest	ENDO	8.00	15.67	10.00	20.00	253.97	1.00
Ocotea laxa	Lauraceae	Atlantic forest	ENDO	13.60	7.00	16.00	8.00	253.97	1.00
Ocotea leucoxylon	Lauraceae	Amazon	ENDO	8.50	9.70	11.40	11.30	100.00	1.00

Ocotea longifolia	Lauraceae	Atlantic forest	ENDO	6.00	11.50	16.00	25.00	230.00	1.00
Ocotea matogrossensis	Lauraceae	Amazon	ENDO	8.50	13.00	11.50	11.50	253.97	1.00
Ocotea minor	Lauraceae	Amazon	ENDO	8.50	13.00	6.00	10.00	253.97	1.00
Ocotea myriantha	Lauraceae	Amazon	ENDO	8.50	13.00	10.00	21.60	253.97	1.00
Ocotea nigrescens	Lauraceae	Amazon	ENDO	8.50	13.00	5.00	10.00	253.97	1.00
Ocotea nitida	Lauraceae	Amazon	ENDO	9.60	9.60	12.10	12.10	253.97	1.00
Ocotea odorifera	Lauraceae	Atlantic forest	ENDO	13.65	19.01	11.76	20.44	300.30	1.00
Ocotea percurrens	Lauraceae	Amazon	ENDO	8.50	12.00	6.50	12.00	253.97	1.00
Ocotea pomaderroides	Lauraceae	Cerrado	ENDO	8.50	13.00	6.10	13.93	753.45	1.00
Ocotea pulchella	Lauraceae	Atlantic forest	ENDO	5.00	7.55	6.80	9.40	253.97	1.00
Ocotea rhodophylla	Lauraceae	Amazon	ENDO	8.50	13.00	10.00	13.93	253.97	1.00
Ocotea scabrella	Lauraceae	Amazon	ENDO	8.50	13.00	10.00	13.93	253.97	1.00
Ocotea schomburgkiana	Lauraceae	Amazon	ENDO	8.50	13.00	10.00	16.95	253.97	1.00
Ocotea sp	Lauraceae	Atlantic forest	ENDO	8.50	13.00	10.00	13.93	253.97	1.00
Ocotea splendens	Lauraceae	Amazon	ENDO	8.50	13.00	11.00	11.00	253.97	1.00
Ocotea tabacifolia	Lauraceae	Amazon	ENDO	8.50	13.00	10.00	14.32	253.97	1.00
Ocotea teleiandra	Lauraceae	Atlantic forest	ENDO	16.00	20.00	17.00	21.00	1900.00	1.00
Oenocarpus bacaba	Arecaceae	Amazon	ENDO	12.89	16.23	18.00	20.00	1430.00	1.00
Oenocarpus bataua	Arecaceae	Amazon	ENDO	20.00	32.00	20.00	39.00	5485.00	1.00
Oenocarpus minor	Arecaceae	Amazon	ENDO	8.81	10.31	15.87	19.96	600.00	1.00
Ormosia flava	Fabaceae	Amazon	ENDO	11.50	12.00	30.58	39.05	318.41	3.00
Ormosia grossa	Fabaceae	Amazon	ENDO	12.00	13.50	30.58	48.28	318.41	3.00
Ormosia minor	Fabaceae	Atlantic forest	ENDO	11.50	13.00	22.50	50.00	318.41	3.00
Ormosia paraensis	Fabaceae	Amazon	ENDO	11.50	13.50	31.38	42.33	318.41	3.00
Ormosia sp	Fabaceae	Amazon	ENDO	11.50	23.81	30.58	45.27	318.41	3.00
Osteophloeum platyspermum	Myristicaceae	Amazon	ENDO	15.00	22.50	34.00	28.00	2290.00	1.00
Otoba parvifolia	Myristicaceae	Amazon	ENDO	16.00	19.50	21.50	29.00	1495.00	1.00

Ouratea castaneifolia	Ochceae	Amazon	ENDO	4.37	5.40	5.68	8.32	56.18	3.50
Ouratea discophora	Ochceae	Amazon	ENDO	3.85	6.23	5.23	7.45	66.45	3.50
Ouratea hexasperma	Ochceae	Cerrado	ENDO	3.78	7.30	4.30	8.33	76.71	3.50
Ouratea odora	Ochceae	Amazon	ENDO	3.85	6.23	5.23	7.66	66.45	3.50
Ouratea parviflora	Ochceae	Atlantic forest	ENDO	3.80	6.35	4.90	7.00	66.45	3.50
Ouratea semiserrata	Ochceae	Atlantic forest	ENDO	3.85	6.10	6.10	8.80	66.45	3.50
Ouratea sp	Ochceae	Amazon	ENDO	3.85	6.23	5.23	7.66	66.45	3.50
Oxandra martiana	Annonaceae	Atlantic forest	ENDO	8.78	12.60	11.55	13.64	419.25	3.50
Oxandra riedeliana	Annonaceae	Amazon	ENDO	8.78	23.80	11.55	13.64	419.25	3.50
Oxandra sessiliflora	Annonaceae	Caatinga	ENDO	8.78	23.80	11.55	13.64	419.25	3.50
Oxandra xylopioides	Annonaceae	Amazon	ENDO	8.78	12.60	11.55	13.64	419.25	3.50
Palicourea corymbifera	Rubiaceae	Amazon	ENDO	3.81	3.00	5.00	4.12	15.45	2.00
Palicourea gracilenta	Rubiaceae	Amazon	ENDO	3.81	3.00	5.00	4.50	15.45	2.00
Palicourea guianensis	Rubiaceae	Amazon	ENDO	3.81	3.00	15.10	6.20	62.43	2.00
Palicourea longistipulata	Rubiaceae	Amazon	ENDO	3.81	3.00	3.50	4.50	15.45	2.00
Palicourea rigida	Rubiaceae	Cerrado	ENDO	3.81	3.00	4.99	5.64	15.45	2.00
Palicourea virens	Rubiaceae	Amazon	ENDO	3.81	3.00	5.00	3.00	15.45	2.00
Parinari excelsa	Chrysobalaceae	Amazon	ENDO	16.00	36.00	19.90	41.00	6290.00	1.00
Parinari montana	Chrysobalaceae	Amazon	ENDO	16.00	90.00	80.90	36.52	140000.00	1.00
Parinari sprucei	Chrysobalaceae	Amazon	ENDO	16.00	30.00	50.00	32.97	6980.00	1.00
Parkia decussata	Fabaceae	Amazon	ENDO	10.00	20.00	50.01	352.59	1508.10	14.00
Parkia multijuga	Fabaceae	Amazon	ENDO	12.00	48.00	75.22	172.04	4009.02	14.00
Parkia nitida	Fabaceae	Amazon	ENDO	9.75	19.75	50.01	210.30	436.87	14.00
Parkia panurensis	Fabaceae	Amazon	ENDO	9.00	15.75	41.12	234.78	407.47	14.00
Parkia pendula	Fabaceae	Amazon	SINZO	9.75	9.00	23.75	193.75	68.41	17.50
Parkia platycephala	Fabaceae	Cerrado	ENDO	5.75	7.75	50.01	98.10	476.19	14.00
Parkia sp	Fabaceae	Amazon	ENDO	9.75	12.70	50.01	204.11	1508.10	14.00

Parkia velutina	Fabaceae	Amazon	SINZO	9.75	9.00	23.75	193.75	68.41	40.00
Pausandra macropetala	Euphorbiaceae	Amazon	ENDO	5.69	8.50	6.60	12.10	380.00	3.00
Pausandra martinii	Euphorbiaceae	Amazon	ENDO	5.69	8.20	6.60	9.50	380.00	3.00
Pausandra morisiana	Euphorbiaceae	Atlantic forest	ENDO	5.69	7.90	6.60	6.90	380.00	3.00
Pausandra trianae	Euphorbiaceae	Amazon	ENDO	5.69	8.20	6.60	9.50	380.00	3.00
Peltogyne catingae	Fabaceae	Amazon	ENDO	9.56	13.86	32.08	23.19	377.94	1.00
Peltogyne confertiflora	Fabaceae	Cerrado	ENDO	16.00	20.00	32.00	74.00	377.94	1.00
Peltogyne excelsa	Fabaceae	Amazon	ENDO	14.00	16.93	32.08	30.36	377.94	1.00
Peltogyne paniculata	Fabaceae	Amazon	ENDO	14.00	16.93	32.15	32.78	377.94	1.00
Peltogyne sp	Fabaceae	Amazon	ENDO	14.00	16.93	32.08	30.36	377.94	1.00
Pera bicolor	Peraceae	Amazon	ENDO	5.50	7.00	5.70	10.89	11.00	3.00
Pera glabrata	Peraceae	Atlantic forest	ENDO	2.50	4.00	5.70	7.92	11.00	3.00
Perebea angustifolia	Moraceae	Amazon	ENDO	6.75	9.35	7.57	10.95	360.15	1.00
Perebea mollis	Moraceae	Amazon	ENDO	6.75	11.20	7.57	29.96	360.15	1.00
Perebea tessmannii	Moraceae	Amazon	ENDO	8.99	9.35	7.57	10.27	629.00	1.00
Perebea xanthochyma	Moraceae	Amazon	ENDO	4.50	7.50	7.57	9.42	103.41	1.00
Picrasma crenata	Simaroubaceae	Atlantic forest	ENDO	8.00	10.00	10.00	10.00	200.00	3.00
Pimenta pseudocaryophyllus	Myrtaceae	Atlantic forest	ENDO	7.59	8.41	13.96	17.53	111.11	2.50
Piper arboreum	Piperaceae	Atlantic forest	ENDO	0.85	0.85	9.00	125.00	1.01	1.00
Piptadenia gonoacantha	Fabaceae	Cerrado	ANEMO	7.59	8.65	22.99	127.46	42.28	10.50
Piptadenia retusa	Fabaceae	Caatinga	ANEMO	5.00	7.00	19.50	105.00	42.28	9.00
Piptocarpha rotundifolia	Asteraceae	Cerrado	ANEMO	2.50	5.00	3.00	5.00	2.63	1.00
Plathymenia reticulata	Fabaceae	Caatinga	ANEMO	13.51	23.15	23.30	156.08	42.30	9.50
Platymiscium floribundum	Fabaceae	Caatinga	ANEMO	11.60	24.80	25.00	59.68	189.20	1.00
Platymiscium pinnatum	Fabaceae	Amazon	ANEMO	10.00	17.50	30.00	65.00	189.20	1.00
Platymiscium sp	Fabaceae	Amazon	ANEMO	10.63	22.50	29.13	65.00	189.20	1.00
Platymiscium trinitatis	Fabaceae	Amazon	ANEMO	10.63	22.50	35.00	72.50	189.20	1.00

Platypodium elegans	Fabaceae	Caatinga	ANEMO	7.00	15.00	20.00	71.12	576.50	1.50
Plenckia populnea	Celastraceae	Cerrado	ANEMO	1.30	21.70	4.13	47.53	95.24	1.50
Plinia rivularis	Myrtaceae	Atlantic forest	ENDO	8.70	10.00	11.50	11.30	1250.00	1.50
Pogonophora schomburgkiana	Peraceae	Atlantic forest	ENDO	2.90	4.60	6.80	8.16	90.91	3.00
Poraqueiba guianensis	Metteniusaceae	Amazon	ENDO	5.46	6.00	20.00	40.00	5200.00	1.00
Poraqueiba sericea	Metteniusaceae	Amazon	ENDO	5.46	6.00	20.00	51.86	5200.00	1.00
Poraqueiba sp	Metteniusaceae	Amazon	ENDO	5.46	6.00	20.00	45.93	5200.00	1.00
Posoqueria latifolia	Rubiaceae	Atlantic forest	ENDO	11.09	13.64	41.42	50.66	196.00	2.00
Posoqueria sp	Rubiaceae	Amazon	ENDO	11.09	22.50	41.42	50.66	196.00	2.00
Pourouma bicolor	Urticaceae	Amazon	ENDO	5.76	10.00	10.00	13.78	216.91	1.00
Pourouma cecropiifolia	Urticaceae	Amazon	ENDO	13.30	20.00	14.00	27.00	708.45	1.00
Pourouma cucura	Urticaceae	Amazon	ENDO	3.00	6.00	11.17	15.57	708.45	1.00
Pourouma ferruginea	Urticaceae	Amazon	ENDO	8.00	10.00	2.00	8.50	708.45	1.00
Pourouma guianensis	Urticaceae	Atlantic forest	ENDO	9.15	17.10	13.10	16.95	1200.00	1.00
Pourouma minor	Urticaceae	Amazon	ENDO	7.50	10.00	11.17	19.38	708.45	1.00
Pourouma mollis	Urticaceae	Amazon	ENDO	10.61	12.80	15.81	15.93	708.45	1.00
Pourouma myrmecophila	Urticaceae	Amazon	ENDO	5.50	10.00	11.17	19.91	708.45	1.00
Pourouma ovata	Urticaceae	Amazon	ENDO	7.50	7.50	11.17	13.62	708.45	1.00
Pourouma sp	Urticaceae	Amazon	ENDO	7.75	10.00	11.17	15.91	708.45	1.00
Pourouma tomentosa	Urticaceae	Amazon	ENDO	8.50	13.45	11.17	17.01	708.45	1.00
Pourouma villosa	Urticaceae	Amazon	ENDO	3.75	4.50	11.17	15.95	708.45	1.00
Pouteria ambelaniifolia	Sapotaceae	Amazon	ENDO	12.81	21.00	21.95	31.00	1254.45	2.00
Pouteria anomala	Sapotaceae	Amazon	ENDO	11.00	16.00	21.69	25.86	736.44	1.00
Pouteria bangii	Sapotaceae	Atlantic forest	ENDO	9.01	30.00	27.60	11.00	1254.45	1.00
Pouteria bilocularis	Sapotaceae	Amazon	ENDO	17.00	30.00	21.95	42.00	1254.45	1.00
Pouteria caimito	Sapotaceae	Atlantic forest	ENDO	12.55	35.28	36.17	43.82	2100.25	1.00
Pouteria campanulata	Sapotaceae	Amazon	ENDO	12.81	21.00	21.95	31.74	1254.45	1.00

Pouteria cladantha	Sapotaceae	Amazon	ENDO	14.00	19.00	18.91	21.69	587.50	1.00
Pouteria coriacea	Sapotaceae	Amazon	ENDO	8.00	19.00	15.00	22.50	1254.45	1.00
Pouteria cuspidata	Sapotaceae	Amazon	ENDO	9.00	17.50	24.00	39.00	600.00	2.00
Pouteria decorticans	Sapotaceae	Amazon	ENDO	12.81	19.00	21.95	29.48	340.00	1.00
Pouteria durlandii	Sapotaceae	Amazon	ENDO	13.00	20.00	21.80	34.00	1390.00	1.50
Pouteria elegans	Sapotaceae	Amazon	ENDO	9.00	27.00	14.29	32.85	930.00	1.00
Pouteria engleri	Sapotaceae	Amazon	ENDO	11.00	19.50	21.95	43.04	1254.45	1.00
Pouteria erythrochrysa	Sapotaceae	Amazon	ENDO	12.81	21.00	21.95	26.18	1254.45	1.00
Pouteria eugeniifolia	Sapotaceae	Amazon	ENDO	12.81	11.50	14.00	17.50	1254.45	1.00
Pouteria filipes	Sapotaceae	Amazon	ENDO	12.81	52.00	33.85	67.50	1254.45	1.00
Pouteria fimbriata	Sapotaceae	Amazon	ENDO	13.50	24.00	28.01	30.49	5470.51	2.00
Pouteria flavilatex	Sapotaceae	Amazon	ENDO	12.81	23.00	21.95	42.50	1254.45	1.00
Pouteria freitasii	Sapotaceae	Amazon	ENDO	12.81	21.00	21.95	29.48	1254.45	1.00
Pouteria gardneri	Sapotaceae	Caatinga	ENDO	10.55	17.79	21.45	25.88	250.00	1.00
Pouteria glomerata	Sapotaceae	Amazon	ENDO	12.62	25.78	36.94	37.24	1162.50	1.00
Pouteria gongrijpii	Sapotaceae	Amazon	ENDO	14.00	24.00	32.50	29.48	1162.50	1.00
Pouteria guianensis	Sapotaceae	Atlantic forest	ENDO	16.00	21.00	48.50	59.50	2730.00	3.00
Pouteria jariensis	Sapotaceae	Amazon	ENDO	9.00	15.00	21.95	62.19	753.42	2.00
Pouteria krukovii	Sapotaceae	Amazon	ENDO	12.81	21.00	21.95	57.90	1254.45	1.00
Pouteria laevigata	Sapotaceae	Amazon	ENDO	16.75	27.90	65.93	75.61	4864.15	4.00
Pouteria macrophylla	Sapotaceae	Amazon	ENDO	49.89	67.30	62.23	82.53	135.19	1.50
Pouteria manaosensis	Sapotaceae	Amazon	ENDO	12.81	21.00	21.94	25.16	13107.41	3.00
Pouteria microstrigosa	Sapotaceae	Atlantic forest	ENDO	9.91	14.90	12.48	20.11	1254.45	1.00
Pouteria minima	Sapotaceae	Amazon	ENDO	9.54	19.67	21.95	24.75	791.06	1.00
Pouteria oblanceolata	Sapotaceae	Amazon	ENDO	14.50	32.00	13.73	23.18	506.93	1.00
Pouteria opposita	Sapotaceae	Amazon	ENDO	13.00	22.50	21.95	23.78	1715.75	1.00
Pouteria oppositifolia	Sapotaceae	Amazon	ENDO	10.30	17.00	12.05	18.02	270.28	1.00

Pouteria pallens	Sapotaceae	Amazon	ENDO	12.81	20.00	21.95	26.50	1240.79	2.00
Pouteria penicillata	Sapotaceae	Amazon	ENDO	12.81	21.00	21.95	29.48	1254.45	1.00
Pouteria petiolata	Sapotaceae	Amazon	ENDO	12.81	21.00	21.95	26.66	1254.45	1.00
Pouteria platyphylla	Sapotaceae	Amazon	ENDO	12.00	19.00	21.95	26.58	1254.45	1.00
Pouteria procera	Sapotaceae	Amazon	ENDO	16.50	21.00	25.05	28.70	2980.00	2.00
Pouteria psammophila	Sapotaceae	Atlantic forest	ENDO	13.13	18.26	15.17	27.30	2630.00	3.00
Pouteria pubescens	Sapotaceae	Amazon	ENDO	11.00	17.00	14.50	22.00	1254.45	1.00
Pouteria ramiflora	Sapotaceae	Cerrado	ENDO	13.52	32.99	32.80	50.35	894.31	1.00
Pouteria reticulata	Sapotaceae	Amazon	ENDO	21.50	18.00	11.10	35.77	1450.00	1.00
Pouteria retinervis	Sapotaceae	Amazon	ENDO	12.81	17.50	21.95	22.13	1254.45	1.00
Pouteria rostrata	Sapotaceae	Amazon	ENDO	1.75	16.00	21.95	16.44	1254.45	1.00
Pouteria sp	Sapotaceae	Atlantic forest	ENDO	12.81	21.00	21.95	29.48	1254.45	1.00
Pouteria speciosa	Sapotaceae	Amazon	ENDO	12.81	21.00	50.00	70.00	53480.00	1.00
Pouteria stipulifera	Sapotaceae	Amazon	ENDO	12.81	20.00	21.95	40.00	1254.45	3.00
Pouteria torta	Sapotaceae	Amazon	ENDO	14.50	29.00	48.00	61.00	2424.32	1.00
Pouteria ucuqui	Sapotaceae	Amazon	ENDO	12.81	21.00	21.95	29.48	1254.45	2.00
Pouteria venosa	Sapotaceae	Atlantic forest	ENDO	28.80	31.30	57.22	59.74	1254.45	2.00
Pouteria vernicosa	Sapotaceae	Amazon	ENDO	11.00	19.00	20.27	27.63	1160.00	1.00
Pouteria virescens	Sapotaceae	Amazon	ENDO	12.81	21.00	29.95	49.25	1254.45	2.00
Pouteria williamii	Sapotaceae	Amazon	ENDO	20.00	23.00	21.95	20.89	1254.45	1.00
Pradosia cochlearia	Sapotaceae	Amazon	ENDO	13.49	25.00	18.41	39.98	2000.00	1.00
Pradosia decipiens	Sapotaceae	Amazon	ENDO	13.49	20.00	17.50	35.71	1839.12	1.00
Pradosia lactescens	Sapotaceae	Atlantic forest	ENDO	13.49	27.58	16.59	29.11	1634.56	1.00
Pradosia schomburgkiana	Sapotaceae	Amazon	ENDO	13.49	11.75	17.50	16.00	1839.12	1.00
Pradosia sp	Sapotaceae	Amazon	ENDO	13.49	22.50	17.50	33.37	1839.12	1.00
Prosopis ruscifolia	Fabaceae	Caatinga	ENDO	3.95	5.50	10.00	210.00	22.20	20.00
Protium altissimum	Burseraceae	Amazon	ENDO	20.00	16.00	16.95	23.09	355.00	2.00

Protium altsonii	Burseraceae	Amazon	ENDO	15.00	18.00	18.31	19.92	668.44	2.00
Protium amazonicum	Burseraceae	Amazon	ENDO	13.00	19.00	17.17	20.75	839.78	2.00
Protium apiculatum	Burseraceae	Amazon	ENDO	12.00	19.00	17.00	76.78	400.00	2.00
Protium aracouchini	Burseraceae	Amazon	ENDO	5.00	11.00	16.95	18.70	355.00	2.00
Protium atlanticum	Burseraceae	Atlantic forest	ENDO	5.50	9.00	16.95	8.59	355.00	2.00
Protium calanense	Burseraceae	Amazon	ENDO	10.25	22.40	16.95	13.61	355.00	2.00
Protium calendulinum	Burseraceae	Amazon	ENDO	10.50	17.00	16.95	20.43	355.00	2.00
Protium carnosum	Burseraceae	Amazon	ENDO	10.25	22.40	16.95	18.70	355.00	2.00
Protium crassipetalum	Burseraceae	Amazon	ENDO	8.60	16.95	19.23	29.40	500.00	2.00
Protium crenatum	Burseraceae	Amazon	ENDO	10.25	15.00	16.95	18.70	355.00	2.00
Protium decandrum	Burseraceae	Amazon	ENDO	13.00	15.00	21.31	19.43	5430.00	2.00
Protium divaricatum	Burseraceae	Amazon	ENDO	3.22	29.17	16.95	18.70	355.00	2.00
Protium elegans	Burseraceae	Amazon	ENDO	8.75	12.50	16.95	10.40	355.00	2.00
Protium ferrugineum	Burseraceae	Amazon	ENDO	10.25	15.00	16.95	17.73	355.00	2.00
Protium gallosum	Burseraceae	Amazon	ENDO	8.95	15.95	26.47	27.74	385.04	2.00
Protium giganteum	Burseraceae	Amazon	ENDO	10.25	15.00	16.95	18.71	355.00	2.00
Protium goudotianum	Burseraceae	Amazon	ENDO	10.25	15.00	16.95	13.79	355.00	2.00
Protium grandifolium	Burseraceae	Amazon	ENDO	16.75	16.35	16.95	19.39	355.00	2.00
Protium hebetatum	Burseraceae	Amazon	ENDO	14.80	17.05	16.95	30.17	355.00	2.00
Protium heptaphyllum	Burseraceae	Amazon	ENDO	7.50	11.57	15.56	21.41	214.93	3.00
Protium klugii	Burseraceae	Amazon	ENDO	10.25	15.00	16.95	18.70	950.24	2.00
Protium laxiflorum	Burseraceae	Amazon	ENDO	10.25	15.00	16.95	18.70	355.00	2.00
Protium neglectum	Burseraceae	Amazon	ENDO	10.25	15.00	24.70	18.69	113.00	2.00
Protium nitidifolium	Burseraceae	Amazon	ENDO	6.68	10.30	18.68	16.26	252.70	2.00
Protium occultum	Burseraceae	Amazon	ENDO	10.25	15.00	16.95	18.70	355.00	2.00
Protium opacum	Burseraceae	Amazon	ENDO	19.10	15.15	22.02	18.70	355.00	2.00
Protium pallidum	Burseraceae	Amazon	ENDO	1.25	15.00	16.95	18.70	355.00	2.00

Protium paniculatum	Burseraceae	Amazon	ENDO	14.50	17.90	16.00	18.70	200.00	2.00
Protium paniculatum var. riedelianum	Burseraceae	Amazon	ENDO	10.25	15.00	16.95	18.70	355.00	2.00
Protium pilosissimum	Burseraceae	Amazon	ENDO	10.25	9.00	10.06	9.40	177.18	2.00
Protium pilosum	Burseraceae	Amazon	ENDO	10.50	15.70	16.95	11.04	355.00	2.00
Protium polybotryum	Burseraceae	Amazon	ENDO	11.00	17.00	16.95	25.82	355.00	2.00
Protium rhoifolium	Burseraceae	Amazon	ENDO	10.25	15.00	12.27	12.32	242.91	2.00
Protium robustum	Burseraceae	Amazon	ENDO	10.25	15.00	17.35	18.83	190.82	2.00
Protium rubrum	Burseraceae	Amazon	ENDO	10.25	15.00	16.95	26.68	355.00	2.00
Protium sagotianum	Burseraceae	Amazon	ENDO	11.00	13.00	17.00	18.70	339.13	2.00
Protium sp	Burseraceae	Amazon	ENDO	10.25	15.00	16.95	18.70	355.00	2.00
Protium spruceanum	Burseraceae	Atlantic forest	ENDO	5.00	10.00	11.00	15.00	104.17	2.00
Protium stevensonii	Burseraceae	Amazon	ENDO	17.00	15.00	16.95	20.24	355.00	2.00
Protium strumosum	Burseraceae	Amazon	ENDO	10.25	15.00	16.95	19.50	355.00	2.00
Protium subserratum	Burseraceae	Amazon	ENDO	9.00	10.00	15.87	16.17	300.00	2.00
Protium surinamense	Burseraceae	Amazon	ENDO	10.25	15.00	20.00	20.00	355.00	2.00
Protium tenuifolium	Burseraceae	Amazon	ENDO	10.25	15.00	17.11	18.24	145.82	2.00
Protium trifoliolatum	Burseraceae	Amazon	ENDO	8.00	11.00	11.64	14.39	140.00	2.00
Protium unifoliolatum	Burseraceae	Amazon	ENDO	10.25	15.00	8.06	10.54	96.23	2.00
Protium widgrenii	Burseraceae	Atlantic forest	ENDO	9.00	15.00	11.00	11.60	100.00	2.00
Prunus myrtifolia	Rosaceae	Atlantic forest	ENDO	5.40	7.59	11.00	1.90	347.07	1.00
Pseudima frutescens	Sapindaceae	Amazon	ENDO	12.53	26.50	33.18	30.00	3700.00	1.50
Pseudobombax grandiflorum	Malvaceae	Atlantic forest	ANEMO	4.82	5.81	30.00	185.15	54.21	170.00
Pseudobombax munguba	Malvaceae	Amazon	ANEMO	4.00	4.50	40.00	185.15	10.80	1953.00
Pseudobombax simplicifolium	Malvaceae	Caatinga	ANEMO	4.82	5.31	35.00	185.15	13.00	1061.50
Pseudobombax sp	Malvaceae	Amazon	ANEMO	4.82	5.31	35.00	185.15	13.00	1061.50
Pseudolmedia laevigata	Moraceae	Amazon	ENDO	4.94	8.15	7.88	11.09	272.50	1.00

Pseudolmedia laevis	Moraceae	Amazon	ENDO	4.25	8.00	7.07	9.90	272.50	1.00
Pseudolmedia macrophylla	Moraceae	Amazon	ENDO	4.50	11.00	7.07	9.73	272.50	1.00
Pseudolmedia sp	Moraceae	Amazon	ENDO	4.50	9.00	7.07	9.86	272.50	1.00
Pseudopiptadenia suaveolens	Fabaceae	Amazon	ANEMO	13.00	44.30	12.50	600.00	48.54	7.50
Psidium cattleyanum	Myrtaceae	Atlantic forest	ENDO	3.00	3.65	18.25	20.45	15.39	30.00
Psidium myrsinites	Myrtaceae	Caatinga	ENDO	2.30	6.00	16.50	18.33	20.00	30.00
Psidium myrtoides	Myrtaceae	Cerrado	ENDO	6.00	7.00	20.00	25.00	17.69	30.00
Psidium salutare	Myrtaceae	Cerrado	ENDO	3.00	6.00	18.25	20.45	17.69	30.00
Psidium sp	Myrtaceae	Caatinga	ENDO	3.00	44.30	18.25	20.45	17.69	30.00
Psychotria nuda	Rubiaceae	Atlantic forest	ENDO	9.70	9.70	7.00	8.70	56.51	1.50
Psychotria rhombibractea	Rubiaceae	Amazon	ENDO	3.00	44.30	7.00	6.90	49.49	1.50
Psychotria sp	Rubiaceae	Amazon	ENDO	3.00	8.05	7.00	7.05	49.49	1.50
Psychotria suterella	Rubiaceae	Atlantic forest	ENDO	3.00	8.05	6.10	6.20	54.82	1.50
Psychotria vellosiana	Rubiaceae	Atlantic forest	ENDO	2.10	6.40	7.20	10.20	13.98	1.50
Pterocarpus rohrii	Fabaceae	Atlantic forest	ANEMO	4.55	13.40	60.10	60.81	139.50	1.50
Pterocarpus sp	Fabaceae	Amazon	ANEMO	4.55	13.40	60.10	60.81	139.50	1.50
Pterocarpus zehntneri	Fabaceae	Caatinga	ANEMO	4.55	13.40	1.31	2.59	139.50	1.50
Pterodon abruptus	Fabaceae	Caatinga	ANEMO	27.82	26.31	1.31	2.59	1293.86	1.00
Pterodon emarginatus	Fabaceae	Cerrado	ANEMO	15.41	19.15	1.31	3.18	1293.86	1.00
Pterodon pubescens	Fabaceae	Cerrado	ANEMO	27.88	46.47	45.00	55.00	1293.86	1.00
Qualea acuminata	Vochysiaceae	Amazon	ANEMO	11.00	31.00	29.00	36.50	74.63	21.00
Qualea dichotoma	Vochysiaceae	Cerrado	ANEMO	5.40	18.20	18.00	30.00	104.22	12.50
Qualea dinizii	Vochysiaceae	Amazon	ANEMO	11.00	31.00	29.00	36.50	74.63	21.00
Qualea grandiflora	Vochysiaceae	Caatinga	ANEMO	13.15	40.30	90.00	87.50	74.63	39.00
Qualea multiflora	Vochysiaceae	Cerrado	ANEMO	11.00	31.00	30.00	36.50	74.63	21.00
Qualea paraensis	Vochysiaceae	Amazon	ANEMO	11.00	31.00	29.00	36.50	74.63	6.00
Qualea parviflora	Vochysiaceae	Caatinga	ANEMO	7.70	26.60	28.00	35.00	41.06	21.00

Qualea selloi	Vochysiaceae	Caatinga	ANEMO	11.00	31.00	29.00	36.50	74.63	21.00
Qualea sp	Vochysiaceae	Amazon	ANEMO	11.00	31.00	29.00	36.50	74.63	21.00
Qualea tessmannii	Vochysiaceae	Amazon	ANEMO	11.00	31.00	29.00	36.50	74.63	21.00
Quararibea amazonica	Malvaceae	Amazon	ENDO	8.00	13.67	18.91	20.62	230.00	2.00
Quararibea guianensis	Malvaceae	Amazon	ENDO	15.00	10.50	20.00	20.62	230.00	2.00
Quararibea sp	Malvaceae	Amazon	ENDO	8.00	10.50	18.91	20.62	230.00	2.00
Quararibea turbinata	Malvaceae	Atlantic forest	ENDO	13.00	12.00	17.82	20.62	4232.00	2.00
Quararibea wittii	Malvaceae	Amazon	ENDO	7.00	10.00	18.91	20.62	225.00	2.00
Rhamnidium elaeocarpum	Rhamanaceae	Atlantic forest	ENDO	5.50	11.00	10.00	13.50	143.31	1.00
Roucheria columbiana	Liceae	Amazon	ENDO	5.00	10.00	6.50	8.44	121.88	1.00
Roupala longepetiolata	Proteaceae	Atlantic forest	ANEMO	6.21	6.91	12.50	28.50	47.00	2.00
Roupala montana	Proteaceae	Cerrado	ANEMO	6.21	6.91	11.50	28.50	47.00	2.00
Roupala montana var paraensis	Proteaceae	Atlantic forest	ANEMO	6.21	6.91	11.50	27.50	47.00	2.00
Rourea induta	Connaraceae	Cerrado	ENDO	5.00	9.50	5.30	12.25	102.68	1.00
Rudgea jasminoides	Rubiaceae	Atlantic forest	ENDO	5.25	7.00	9.40	9.60	200.00	1.00
Rudgea lanceifolia	Rubiaceae	Amazon	ENDO	5.25	5.75	8.40	44.13	200.00	1.50
Rudgea recurva	Rubiaceae	Atlantic forest	ENDO	5.25	4.00	7.40	9.00	200.00	1.50
Rudgea triflora	Rubiaceae	Atlantic forest	ENDO	4.00	4.50	6.00	5.50	200.00	1.50
Rudgea vellerea	Rubiaceae	Atlantic forest	ENDO	6.50	11.00	9.50	24.00	200.00	1.50
Ruprechtia apetala	Polygoceae	Caatinga	ANEMO	3.20	8.00	5.00	12.00	16850.00	1.00
Ruprechtia laxiflora	Polygoceae	Caatinga	ANEMO	3.20	8.00	5.00	12.00	29740.00	1.00
Sacoglottis amazonica	Humiriaceae	Amazon	ENDO	36.19	26.00	21.62	51.13	4994.00	1.00
Sacoglottis ceratocarpa	Humiriaceae	Amazon	ENDO	36.19	26.00	21.62	48.31	3950.00	1.00
Sacoglottis guianensis	Humiriaceae	Amazon	ENDO	36.19	26.00	25.20	36.47	3950.00	1.00
Sacoglottis mattogrossensis	Humiriaceae	Amazon	ENDO	36.19	26.00	17.27	21.73	3950.00	1.00
Sacoglottis sp	Humiriaceae	Amazon	ENDO	36.19	26.00	21.62	41.30	3950.00	1.00
Salacia crassifolia	Celastraceae	Cerrado	ENDO	12.43	18.76	23.47	21.99	1061.49	3.50

Salacia elliptica	Celastraceae	Atlantic forest	ENDO	15.00	21.60	30.80	38.50	1061.49	6.00
Salacia sp	Celastraceae	Amazon	ENDO	13.72	20.18	30.80	38.29	1061.49	4.75
Sapium glandulosum	Euphorbiaceae	Caatinga	ENDO	5.00	5.31	9.50	10.85	28.00	3.00
Sapium marmieri	Euphorbiaceae	Amazon	ENDO	3.00	5.00	12.50	11.25	30.00	3.00
Sapium sp	Euphorbiaceae	Amazon	ENDO	5.00	5.00	12.50	11.25	29.00	3.00
Schinopsis brasiliensis	Anacardiaceae	Caatinga	ANEMO	9.07	13.77	11.66	37.70	159.51	1.00
Simaba guianensis	Simaroubaceae	Amazon	ENDO	8.00	15.00	10.74	12.46	255.00	1.00
Simaba polyphylla	Simaroubaceae	Amazon	ENDO	8.00	15.00	10.74	11.89	255.00	1.00
Simaba sp	Simaroubaceae	Amazon	ENDO	8.00	15.00	10.74	12.09	255.00	1.00
Simarouba amara	Simaroubaceae	Amazon	ENDO	6.60	12.20	8.73	15.23	234.00	1.00
Simarouba polyphylla	Simaroubaceae	Amazon	ENDO	6.60	12.20	10.25	15.23	302.00	1.00
Simarouba versicolor	Simaroubaceae	Cerrado	ENDO	11.58	18.23	14.05	18.20	1260.00	1.00
Siparuna bifida	Siparuceae	Atlantic forest	ENDO	5.00	13.00	9.50	12.98	85.00	12.00
Siparuna cristata	Siparuceae	Amazon	ENDO	5.00	13.00	9.50	12.01	85.00	12.00
Siparuna cuspidata	Siparuceae	Amazon	SINZO	5.00	4.18	10.00	10.14	20.00	12.00
Siparuna decipiens	Siparuceae	Amazon	ENDO	5.50	14.00	12.00	13.20	85.00	12.00
Siparuna glycycarpa	Siparuceae	Amazon	ENDO	5.00	13.00	9.50	32.12	85.00	12.00
Siparuna guianensis	Siparuceae	Atlantic forest	SINZO	5.00	4.18	9.40	10.14	20.00	12.00
Siparuna poeppigii	Siparuceae	Amazon	ENDO	5.00	13.00	9.50	10.22	85.00	12.00
Siparuna reginae	Siparuceae	Amazon	ENDO	1.49	3.00	7.00	11.00	85.00	12.00
Siparuna sarmentosa	Siparuceae	Amazon	ENDO	5.00	13.00	9.50	39.03	85.00	12.00
Siparuna sp	Siparuceae	Atlantic forest	ENDO	5.00	13.00	9.50	13.20	85.00	12.00
Siphoneugena crassifolia	Myrtaceae	Atlantic forest	ENDO	5.30	7.00	8.80	1.60	62.46	1.50
Siphoneugena densiflora	Myrtaceae	Atlantic forest	ENDO	5.07	6.86	7.23	7.71	62.46	1.00
Siphoneugena reitzii	Myrtaceae	Atlantic forest	ENDO	5.30	6.81	6.99	7.13	62.46	2.00
Sloanea floribunda	Elaeocarpaceae	Amazon	ENDO	6.00	12.50	11.70	19.93	200.00	1.00
Sloanea garckeana	Elaeocarpaceae	Amazon	ENDO	6.99	11.40	11.70	16.70	200.00	1.00

Sloanea grandiflora	Elaeocarpaceae	Amazon	ENDO	8.00	18.00	10.00	60.00	200.00	1.00
Sloanea guianensis	Elaeocarpaceae	Atlantic forest	ENDO	6.00	10.00	13.50	16.00	177.00	1.00
Sloanea hirsuta	Elaeocarpaceae	Atlantic forest	ENDO	8.50	17.10	20.00	22.00	200.00	1.00
Sloanea latifolia	Elaeocarpaceae	Amazon	ENDO	10.00	20.00	11.70	26.71	200.00	1.00
Sloanea laurifolia	Elaeocarpaceae	Amazon	ENDO	10.00	17.50	5.24	29.54	550.00	1.00
Sloanea schomburgkii	Elaeocarpaceae	Amazon	ENDO	15.00	20.00	11.70	34.70	200.00	1.00
Sloanea sinemariensis	Elaeocarpaceae	Amazon	ENDO	3.00	6.00	11.70	14.47	200.00	1.00
Sloanea sp	Elaeocarpaceae	Amazon	ENDO	8.00	13.67	11.70	20.85	200.00	1.00
Sloanea synandra	Elaeocarpaceae	Amazon	ENDO	15.00	20.00	40.00	95.00	200.00	1.00
Socratea exorrhiza	Arecaceae	Amazon	ENDO	15.00	19.00	16.56	21.61	4136.00	1.00
Sorocea bonplandii	Moraceae	Atlantic forest	ENDO	9.80	11.20	9.10	11.00	600.00	1.00
Sorocea briquetii	Moraceae	Amazon	ENDO	8.17	10.70	5.17	7.60	390.00	1.00
Sorocea guilleminiana	Moraceae	Atlantic forest	ENDO	9.00	10.20	13.65	15.60	179.04	1.00
Sorocea hilarii	Moraceae	Atlantic forest	ENDO	7.33	10.70	9.44	8.40	383.97	1.00
Sorocea muriculata	Moraceae	Amazon	ENDO	4.37	3.58	7.31	8.36	68.16	1.00
Sorocea sp	Moraceae	Amazon	ENDO	8.17	10.70	8.87	9.06	383.97	1.00
Sparattosperma leucanthum	Bignoniaceae	Amazon	ANEMO	3.50	14.00	15.30	340.00	5.37	405.50
Spondias mombin	Anacardiaceae	Amazon	ENDO	15.00	25.00	21.00	38.00	958.00	1.00
Spondias sp	Anacardiaceae	Amazon	ENDO	15.00	47.90	21.00	38.00	958.00	1.00
Sterculia apetala	Malvaceae	Amazon	SINZO	25.00	35.00	95.00	280.00	1556.19	11.25
Sterculia duckei	Malvaceae	Amazon	SINZO	25.00	17.30	41.50	61.00	1556.19	11.25
Sterculia excelsa	Malvaceae	Amazon	SINZO	13.90	16.65	41.50	61.00	1556.19	17.50
Sterculia frondosa	Malvaceae	Amazon	SINZO	25.00	17.30	41.50	61.00	1556.19	11.25
Sterculia pruriens	Malvaceae	Amazon	SINZO	25.00	17.30	27.00	33.00	1556.19	5.00
Sterculia sp	Malvaceae	Amazon	SINZO	25.00	17.30	41.50	61.00	1556.19	11.25
Strychnos pseudoquina	Loganiaceae	Cerrado	ENDO	18.92	21.35	24.85	30.00	666.50	4.00
Stryphnodendron adstringens	Fabaceae	Cerrado	ENDO	3.00	8.00	17.50	95.00	105.00	15.00

Stryphnodendron coriaceum	Fabaceae	Cerrado	ENDO	5.00	8.00	15.00	80.00	21.60	10.00
Stryphnodendron duckeanum	Fabaceae	Amazon	ENDO	6.00	13.00	14.00	97.17	105.00	10.00
Stryphnodendron guianense	Fabaceae	Amazon	ENDO	6.00	7.50	10.96	67.85	166.00	10.00
Stryphnodendron occhionianum	Fabaceae	Amazon	ENDO	10.00	8.00	14.00	95.37	105.00	4.50
Stryphnodendron paniculatum	Fabaceae	Amazon	ENDO	7.00	10.00	14.00	95.37	105.00	9.00
Stryphnodendron polyphyllum	Fabaceae	Cerrado	ENDO	6.00	9.00	13.00	150.00	105.00	10.50
Stryphnodendron polystachyum	Fabaceae	Amazon	ENDO	4.00	6.00	23.50	105.00	105.00	8.50
Stryphnodendron racemiferum	Fabaceae	Amazon	ENDO	6.00	11.50	14.00	133.38	105.00	11.00
Stryphnodendron sp	Fabaceae	Amazon	ENDO	6.00	8.00	14.00	95.37	105.00	10.00
Stylogyne lhotzkyana	Primulaceae	Atlantic forest	ENDO	7.04	9.00	6.96	7.36	98.80	1.00
Styrax ferrugineus	Styracaceae	Cerrado	ENDO	5.24	7.91	5.97	9.55	89.07	1.00
Styrax latifolius	Styracaceae	Atlantic forest	ENDO	5.24	9.56	5.97	9.55	89.07	1.00
Swartzia arborescens	Fabaceae	Amazon	ENDO	17.50	25.00	29.80	57.00	1883.60	1.75
Swartzia corrugata	Fabaceae	Amazon	ENDO	17.50	24.00	29.80	57.00	1883.60	2.50
Swartzia cuspidata	Fabaceae	Amazon	ENDO	15.00	25.00	29.80	57.00	1883.60	2.50
Swartzia ingifolia	Fabaceae	Amazon	ENDO	17.50	25.00	29.80	57.00	1883.60	2.50
Swartzia lamellata	Fabaceae	Amazon	ENDO	17.50	25.00	29.80	57.00	1883.60	2.50
Swartzia laurifolia	Fabaceae	Amazon	ENDO	17.50	25.00	29.80	57.00	1883.60	3.25
Swartzia panacoco	Fabaceae	Amazon	ENDO	17.50	25.00	29.80	57.00	1883.60	2.50
Swartzia polyphylla	Fabaceae	Amazon	ENDO	27.50	40.92	45.00	92.50	30236.00	2.50
Swartzia racemosa	Fabaceae	Amazon	ENDO	17.50	25.00	29.80	57.00	1883.60	2.50
Swartzia recurva	Fabaceae	Amazon	ENDO	30.00	24.00	29.80	57.00	3188.47	1.50
Swartzia reticulata	Fabaceae	Amazon	ENDO	17.50	25.00	29.80	57.00	28714.59	1.50
Swartzia schomburgkii	Fabaceae	Amazon	ENDO	17.50	25.00	29.80	57.00	1130.00	2.50
Swartzia simplex	Fabaceae	Atlantic forest	ENDO	9.13	22.10	14.60	21.50	1860.40	2.50
Swartzia sp	Fabaceae	Amazon	ENDO	17.50	25.00	29.80	57.00	1883.60	2.50
Swartzia tomentifera	Fabaceae	Amazon	ENDO	17.50	25.00	29.80	57.00	1883.60	2.50

Swartzia ulei	Fabaceae	Amazon	ENDO	17.50	25.00	29.80	57.00	1883.60	2.50
Syagrus cocoides	Arecaceae	Amazon	ENDO	14.50	25.00	19.89	30.78	7203.43	1.00
Syagrus comosa	Arecaceae	Cerrado	ENDO	14.00	25.00	15.00	30.00	1033.75	1.00
Syagrus flexuosa	Arecaceae	Cerrado	ENDO	13.97	20.23	19.89	17.28	5000.00	1.00
Syagrus pseudococos	Arecaceae	Atlantic forest	ENDO	15.00	25.00	42.00	60.00	9588.69	1.00
Symphonia globulifera	Clusiaceae	Amazon	ENDO	21.00	24.33	23.70	11.24	1019.25	3.00
Tabebuia aurea	Bignoniaceae	Cerrado	ANEMO	25.00	65.00	29.33	165.00	26.66	80.00
Tabebuia cassinoides	Bignoniaceae	Atlantic forest	ANEMO	7.00	11.90	11.25	160.00	26.66	92.90
Tabebuia sp	Bignoniaceae	Amazon	ANEMO	13.00	37.00	16.00	170.00	26.66	86.45
Tabebuia stenocalyx	Bignoniaceae	Atlantic forest	ANEMO	13.00	37.00	16.00	170.00	26.66	86.45
Tabernaemontana angulata	Apocyaceae	Amazon	ENDO	2.50	8.00	16.00	30.00	34.49	20.00
Tabernaemontana flavicans	Apocyaceae	Amazon	ENDO	3.75	6.00	16.00	28.80	34.49	20.00
Tabernaemontana heterophylla	Apocyaceae	Amazon	ENDO	4.50	8.00	16.00	32.82	34.49	20.00
Tabernaemontana muricata	Apocyaceae	Amazon	ENDO	4.00	7.94	16.00	44.71	34.49	20.00
Tabernaemontana sp	Apocyaceae	Amazon	ENDO	4.00	7.94	16.00	32.29	34.49	20.00
Tabernaemontana undulata	Apocyaceae	Amazon	ENDO	4.00	7.94	16.00	19.11	34.49	20.00
Tabernaemontana vanheurckii	Apocyaceae	Amazon	ENDO	4.66	7.88	16.00	45.62	34.49	20.00
Tachigali alba	Fabaceae	Amazon	ANEMO	11.20	19.00	19.02	47.79	180.00	2.00
Tachigali amplifolia	Fabaceae	Amazon	ANEMO	11.20	19.00	15.00	90.00	180.00	2.00
Tachigali aurea	Fabaceae	Cerrado	ANEMO	8.20	13.10	25.00	55.00	180.00	2.00
Tachigali chrysophylla	Fabaceae	Amazon	ANEMO	19.00	19.00	19.02	47.79	180.00	2.00
Tachigali denudata	Fabaceae	Atlantic forest	ANEMO	19.75	39.17	40.00	110.00	180.00	2.00
Tachigali eriopetala	Fabaceae	Amazon	ANEMO	11.20	19.00	19.02	47.79	180.00	2.00
Tachigali glauca	Fabaceae	Amazon	ANEMO	11.20	19.00	19.02	47.79	180.00	2.00
Tachigali guianensis	Fabaceae	Amazon	ANEMO	13.00	23.00	19.02	47.79	180.00	2.00
Tachigali melanocarpa	Fabaceae	Amazon	ANEMO	11.20	19.00	19.02	47.79	180.00	2.00
Tachigali micropetala	Fabaceae	Amazon	ANEMO	11.20	19.00	19.02	47.79	180.00	2.00

Tachigali paniculata	Fabaceae	Amazon	ANEMO	10.00	25.00	19.02	47.79	345.00	2.00
Tachigali paraensis	Fabaceae	Amazon	ANEMO	11.20	19.00	19.02	47.79	180.00	2.00
Tachigali plumbea	Fabaceae	Amazon	ANEMO	11.20	19.00	19.02	47.79	180.00	2.00
Tachigali prancei	Fabaceae	Amazon	ANEMO	11.20	19.00	19.02	47.79	180.00	2.00
Tachigali rugosa	Fabaceae	Atlantic forest	ANEMO	10.40	15.00	10.40	15.00	180.00	2.00
Tachigali setifera	Fabaceae	Amazon	ANEMO	11.20	19.00	19.02	47.79	180.00	2.00
Tachigali sp	Fabaceae	Amazon	ANEMO	11.20	19.00	19.02	47.79	180.00	1.00
Tachigali subvelutina	Fabaceae	Cerrado	ANEMO	11.20	19.00	35.00	60.00	180.00	2.00
Tachigali venusta	Fabaceae	Amazon	ANEMO	11.20	19.00	19.02	47.79	180.00	2.00
Tachigali vulgaris	Fabaceae	Cerrado	ANEMO	6.97	11.48	13.04	40.58	180.00	2.00
Talisia angustifolia	Sapindaceae	Amazon	ENDO	12.00	15.00	25.00	22.95	7140.00	1.00
Talisia carinata	Sapindaceae	Amazon	ENDO	10.40	15.00	22.50	22.57	7140.00	1.00
Talisia cerasina	Sapindaceae	Amazon	ENDO	6.30	8.70	15.00	21.10	7140.00	1.00
Talisia cupularis	Sapindaceae	Amazon	ENDO	8.81	14.50	22.50	28.20	7140.00	1.00
Talisia eximia	Sapindaceae	Amazon	ENDO	10.40	15.00	22.50	22.95	7140.00	1.00
Talisia longifolia	Sapindaceae	Amazon	ENDO	10.40	15.00	22.50	19.63	7140.00	1.00
Talisia macrophylla	Sapindaceae	Amazon	ENDO	16.00	19.00	22.50	23.96	7140.00	1.00
Talisia marleneana	Sapindaceae	Amazon	ENDO	10.40	15.00	22.50	22.45	7140.00	1.00
Talisia microphylla	Sapindaceae	Amazon	ENDO	10.40	15.00	20.00	22.95	7140.00	1.00
Talisia mollis	Sapindaceae	Amazon	ENDO	10.40	15.00	22.50	22.63	7140.00	1.00
Talisia sp	Sapindaceae	Amazon	ENDO	10.40	15.00	22.50	22.95	7140.00	1.00
Tapirira guianensis	Anacardiaceae	Atlantic forest	ENDO	6.08	6.90	9.55	13.00	85.00	1.00
Tapirira obtusa	Anacardiaceae	Atlantic forest	ENDO	6.55	12.80	14.35	12.00	196.08	1.00
Tapirira sp	Anacardiaceae	Amazon	ENDO	6.55	9.00	10.65	12.00	140.54	1.00
Tapura amazonica	Dichapetalaceae	Amazon	SINZO	10.76	19.05	18.60	23.96	184.63	1.00
Tapura guianensis	Dichapetalaceae	Amazon	SINZO	10.76	19.05	10.50	16.00	184.63	1.00
Tapura juruana	Dichapetalaceae	Amazon	SINZO	10.76	19.05	17.80	23.81	184.63	1.00

Tapura lanceolata	Dichapetalaceae	Amazon	SINZO	10.76	19.05	17.80	23.81	184.63	1.00
Terminalia argentea	Combretaceae	Cerrado	ANEMO	1.65	13.00	17.20	38.50	238.00	1.00
Terminalia congesta	Combretaceae	Amazon	SINZO	19.75	15.00	11.00	21.50	923.00	1.00
Terminalia eichleriana	Combretaceae	Caatinga	ANEMO	1.65	5.40	11.00	7.50	141.23	1.00
Terminalia fagifolia	Combretaceae	Caatinga	ANEMO	1.60	5.40	10.00	15.01	44.47	1.00
Terminalia glabrescens	Combretaceae	Cerrado	ANEMO	1.70	3.00	8.90	4.80	141.23	1.00
Terminalia grandis	Combretaceae	Amazon	SINZO	19.75	26.00	13.50	29.50	923.00	1.00
Terminalia ochroprumna	Combretaceae	Amazon	SINZO	19.75	16.46	12.00	24.00	923.00	1.00
Terminalia parvifolia	Combretaceae	Amazon	SINZO	19.75	16.46	11.50	18.00	923.00	1.00
Terminalia phaeocarpa	Combretaceae	Caatinga	ANEMO	1.65	5.40	33.17	24.92	141.23	1.00
Terminalia sp	Combretaceae	Amazon	SINZO	19.75	16.46	13.00	24.00	923.00	1.00
Terminalia tetraphylla	Combretaceae	Amazon	SINZO	10.25	16.46	14.50	20.67	626.50	1.00
Ternstroemia sp	Pentaphylacaceae	Amazon	ENDO	5.00	8.50	10.00	12.50	730.00	5.00
Ternstroemia urophora	Pentaphylacaceae	Amazon	ENDO	5.00	8.50	10.00	12.50	730.00	5.00
Toulicia guianensis	Sapindaceae	Amazon	ANEMO	3.50	3.00	22.50	34.40	74.07	3.00
Toulicia reticulata	Sapindaceae	Amazon	ANEMO	5.00	6.00	31.00	34.50	74.04	3.00
Toulicia subsquamulata	Sapindaceae	Atlantic forest	ANEMO	7.00	7.00	26.50	39.50	74.04	3.00
Tovomita choisyana	Clusiaceae	Amazon	ENDO	7.39	17.80	12.00	21.00	270.00	5.00
Tovomita fructipendula	Clusiaceae	Amazon	ENDO	8.79	15.60	12.00	36.80	270.00	5.00
Tovomita hopkinsii	Clusiaceae	Amazon	ENDO	6.00	20.00	12.00	45.05	270.00	5.00
Tovomita sp	Clusiaceae	Amazon	ENDO	7.39	17.80	12.00	36.80	270.00	5.00
Tovomita spruceana	Clusiaceae	Amazon	ENDO	7.39	17.80	12.00	42.17	270.00	5.00
Tovomita umbellata	Clusiaceae	Amazon	ENDO	7.39	17.80	12.00	31.28	270.00	5.00
Trattinnickia boliviana	Burseraceae	Amazon	ENDO	6.53	8.05	11.34	11.58	1315.00	1.00
Trattinnickia burserifolia	Burseraceae	Amazon	ENDO	6.53	8.05	7.00	8.00	1315.00	1.00
Trattinnickia glaziovii	Burseraceae	Amazon	ENDO	6.53	8.05	12.00	13.20	1315.00	1.00
Trattinnickia lancifolia	Burseraceae	Amazon	ENDO	6.53	8.05	11.34	11.16	1315.00	1.00

Trattinnickia rhoifolia	Burseraceae	Amazon	ENDO	6.53	8.05	11.34	11.77	1315.00	1.00
Trattinnickia sp	Burseraceae	Amazon	ENDO	6.53	8.05	11.34	11.58	1315.00	1.00
Trichilia adolfi	Meliaceae	Amazon	ENDO	16.00	23.00	6.12	14.10	105.00	1.50
Trichilia areolata	Meliaceae	Amazon	ENDO	10.00	20.00	6.12	20.22	105.00	1.50
Trichilia casaretti	Meliaceae	Caatinga	ENDO	4.31	9.54	9.57	11.67	136.99	1.50
Trichilia catigua	Meliaceae	Atlantic forest	ENDO	5.00	12.00	5.40	20.00	128.21	1.50
Trichilia clausseni	Meliaceae	Atlantic forest	ENDO	8.50	12.25	6.00	11.77	105.00	1.00
Trichilia emarginata	Meliaceae	Caatinga	ENDO	8.50	12.00	3.20	12.60	105.00	1.50
Trichilia micrantha	Meliaceae	Amazon	ENDO	7.00	8.75	6.12	10.06	105.00	1.50
Trichilia pallida	Meliaceae	Amazon	ENDO	5.63	6.13	6.37	7.42	61.95	1.00
Trichilia pleeana	Meliaceae	Amazon	ENDO	9.00	14.00	5.70	14.70	355.00	1.50
Trichilia quadrijuga	Meliaceae	Amazon	ENDO	8.50	15.75	8.58	24.62	89.22	1.50
Trichilia rubra	Meliaceae	Amazon	ENDO	11.50	18.00	6.50	13.50	105.00	1.50
Trichilia schomburgkii	Meliaceae	Amazon	ENDO	8.50	14.00	6.12	19.76	105.00	1.50
Trichilia septentrionalis	Meliaceae	Amazon	ENDO	12.50	12.25	6.12	12.36	105.00	1.50
Trichilia silvatica	Meliaceae	Atlantic forest	ENDO	3.00	7.00	5.05	8.40	42.02	1.50
Trichilia solitudinis	Meliaceae	Amazon	ENDO	10.00	25.00	6.12	21.21	105.00	1.50
Trichilia sp	Meliaceae	Amazon	ENDO	8.50	12.25	6.12	14.10	105.00	1.50
Triplaris gardneriana	Polygoceae	Caatinga	ANEMO	5.00	8.00	23.00	35.00	58.82	1.00
Trymatococcus amazonicus	Moraceae	Amazon	ENDO	12.10	16.50	13.06	18.00	1070.00	1.00
Unonopsis duckei	Annonaceae	Amazon	ENDO	7.50	10.00	12.00	10.63	200.00	2.50
Unonopsis guatterioides	Annonaceae	Amazon	ENDO	9.00	9.00	11.25	22.25	200.00	4.00
Unonopsis rufescens	Annonaceae	Amazon	ENDO	10.00	10.00	15.00	13.51	30.00	2.50
Unonopsis sp	Annonaceae	Amazon	ENDO	9.00	18.00	12.00	13.51	200.00	2.50
Unonopsis stipitata	Annonaceae	Amazon	ENDO	9.00	12.00	7.10	14.60	530.00	2.50
Urera baccifera	Urticaceae	Atlantic forest	ENDO	2.00	2.00	3.15	3.45	50.00	1.00
Urera caracasana	Urticaceae	Amazon	ENDO	6.50	2.00	3.50	4.70	0.30	1.00

Vachellia farnesiana	Fabaceae	Caatinga	ENDO	5.00	7.50	11.26	47.55	97.00	18.50
Vantanea compacta	Humiriaceae	Atlantic forest	ENDO	22.00	24.00	20.00	25.00	1613.25	1.00
Vantanea guianensis	Humiriaceae	Amazon	ENDO	10.50	20.50	22.19	54.35	1431.63	1.00
Vantanea macrocarpa	Humiriaceae	Amazon	ENDO	13.26	20.50	22.19	32.31	1431.63	1.00
Vantanea micrantha	Humiriaceae	Amazon	ENDO	13.26	20.50	22.19	20.23	1431.63	1.00
Vantanea paraensis	Humiriaceae	Amazon	ENDO	13.26	15.45	22.19	30.88	1431.63	1.00
Vantanea parviflora	Humiriaceae	Amazon	ENDO	19.00	20.50	24.38	27.31	1250.00	1.00
Vantanea sp	Humiriaceae	Atlantic forest	ENDO	13.26	20.50	22.19	30.88	1431.63	1.00
Vatairea erythrocarpa	Fabaceae	Amazon	ANEMO	14.25	22.50	32.00	90.00	1039.20	1.00
Vatairea macrocarpa	Fabaceae	Caatinga	ANEMO	18.00	25.50	32.00	90.00	1039.20	1.00
Vatairea paraensis	Fabaceae	Amazon	ANEMO	13.50	23.00	32.00	90.00	1039.20	1.00
Vatairea sericea	Fabaceae	Amazon	ANEMO	11.00	18.00	32.00	90.00	1039.20	1.00
Vatairea sp	Fabaceae	Amazon	ANEMO	14.25	22.50	32.00	90.00	1039.20	1.00
Virola bicuhyba	Myristicaceae	Atlantic forest	ENDO	16.00	24.00	21.00	36.80	1770.35	1.00
Virola caducifolia	Myristicaceae	Amazon	ENDO	12.50	19.00	18.00	21.04	918.95	1.00
Virola calophylla	Myristicaceae	Amazon	ENDO	10.00	14.00	9.16	13.91	780.00	1.00
Virola carinata	Myristicaceae	Amazon	ENDO	14.50	15.00	13.35	27.66	918.95	1.00
Virola crebrinervia	Myristicaceae	Amazon	ENDO	13.50	16.50	13.35	22.13	918.95	1.00
Virola elongata	Myristicaceae	Amazon	ENDO	8.00	8.00	10.26	13.15	200.00	1.00
Virola flexuosa	Myristicaceae	Amazon	ENDO	12.00	14.50	13.35	15.79	1039.48	1.00
Virola gardneri	Myristicaceae	Atlantic forest	ENDO	22.50	26.00	21.67	30.68	2377.51	1.00
Virola michelii	Myristicaceae	Amazon	ENDO	13.00	20.00	15.00	21.04	1880.00	1.00
Virola mollissima	Myristicaceae	Amazon	ENDO	13.50	18.50	13.35	25.78	918.95	1.00
Virola multiflora	Myristicaceae	Amazon	ENDO	12.00	15.50	13.35	21.04	734.69	1.00
Virola multinervia	Myristicaceae	Amazon	ENDO	12.00	30.00	13.35	26.03	918.95	1.00
Virola pavonis	Myristicaceae	Amazon	ENDO	13.00	22.00	14.90	20.47	1746.00	1.00
Virola sebifera	Myristicaceae	Cerrado	ENDO	10.75	14.59	10.76	16.92	487.00	1.00

Virola sp	Myristicaceae	Amazon	ENDO	12.00	15.50	13.35	21.04	918.95	1.00
Virola venosa	Myristicaceae	Amazon	ENDO	12.50	14.50	13.35	18.97	918.95	1.00
Vismia baccifera	Hypericaceae	Amazon	ENDO	0.98	2.35	7.70	9.38	0.90	177.64
Vismia brasiliensis	Hypericaceae	Atlantic forest	ENDO	1.10	3.00	8.00	8.00	0.79	177.64
Vismia cayennensis	Hypericaceae	Amazon	ENDO	0.50	1.74	5.39	10.04	1.00	177.64
Vismia guianensis	Hypericaceae	Amazon	ENDO	5.00	15.00	7.70	8.50	0.90	177.64
Vismia sessilifolia	Hypericaceae	Amazon	ENDO	0.85	2.05	7.70	12.12	0.90	177.64
Vismia sp	Hypericaceae	Amazon	ENDO	0.98	2.10	7.70	9.38	0.90	177.64
Vitex cymosa	Lamiaceae	Atlantic forest	ENDO	8.60	17.10	20.00	15.67	209.00	4.00
Vitex duckei	Lamiaceae	Amazon	ENDO	8.90	16.35	15.60	15.67	374.75	4.00
Vitex megapotamica	Lamiaceae	Cerrado	ENDO	8.90	13.30	20.00	20.00	250.00	4.00
Vitex polygama	Lamiaceae	Atlantic forest	ENDO	11.30	16.35	14.63	15.67	499.50	4.00
Vitex schaueriana	Lamiaceae	Caatinga	ENDO	8.90	16.35	15.60	15.67	374.75	4.00
Vitex sp	Lamiaceae	Amazon	ENDO	8.90	16.35	15.60	15.67	374.75	4.00
Vitex sprucei	Lamiaceae	Amazon	ENDO	8.90	16.35	15.60	15.67	374.75	4.00
Vitex triflora	Lamiaceae	Amazon	ENDO	8.90	16.35	13.20	14.40	374.75	4.00
Vochysia biloba	Vochysiaceae	Amazon	ANEMO	7.10	29.30	21.00	30.00	19.85	3.00
Vochysia citrifolia	Vochysiaceae	Amazon	ANEMO	7.10	29.30	21.00	30.00	19.85	3.00
Vochysia elliptica	Vochysiaceae	Cerrado	ANEMO	7.10	29.30	21.00	30.00	19.85	3.00
Vochysia ferruginea	Vochysiaceae	Amazon	ANEMO	7.10	29.30	21.00	30.00	17.52	3.00
Vochysia gardneri	Vochysiaceae	Cerrado	ANEMO	7.10	29.30	21.00	30.00	19.85	3.00
Vochysia guianensis	Vochysiaceae	Amazon	ANEMO	7.10	29.30	21.00	30.00	19.85	3.00
Vochysia magnifica	Vochysiaceae	Atlantic forest	ANEMO	7.10	28.60	20.00	30.00	19.85	3.00
Vochysia maxima	Vochysiaceae	Amazon	ANEMO	7.10	29.30	21.00	30.00	19.85	3.00
Vochysia obscura	Vochysiaceae	Amazon	ANEMO	7.10	29.30	21.00	30.00	19.85	3.00
Vochysia rufa	Vochysiaceae	Cerrado	ANEMO	7.10	30.00	43.00	88.00	19.85	3.00
Vochysia rufescens	Vochysiaceae	Amazon	ANEMO	7.10	29.30	21.00	30.00	19.85	3.00

Vochysia sp	Vochysiaceae	Amazon	ANEMO	7.10	29.30	21.00	30.00	19.85	3.00
Vochysia splendens	Vochysiaceae	Amazon	ANEMO	7.10	29.30	21.00	30.00	19.85	3.00
Vochysia thyrsoidea	Vochysiaceae	Cerrado	ANEMO	10.00	30.00	22.00	30.00	19.85	3.00
Vochysia tucanorum	Vochysiaceae	Atlantic forest	ANEMO	5.50	22.20	12.00	25.00	25.13	3.00
Vouacapoua americana	Fabaceae	Amazon	SINZO	30.00	40.00	39.79	63.89	32600.00	1.00
Vouacapoua pallidior	Fabaceae	Amazon	SINZO	30.00	40.00	39.79	63.89	32600.00	1.00
Ximenia americana	Olacaceae	Caatinga	ENDO	16.00	8.05	18.80	18.90	714.00	1.00
Xylopia amazonica	Annonaceae	Amazon	ENDO	4.65	5.00	7.30	11.05	29.64	2.25
Xylopia aromatica	Annonaceae	Cerrado	ENDO	3.80	7.00	11.00	25.50	71.98	10.00
Xylopia barbata	Annonaceae	Amazon	ENDO	10.00	6.50	8.00	37.73	71.98	2.50
Xylopia brasiliensis	Annonaceae	Atlantic forest	ENDO	4.10	5.80	4.50	26.00	45.43	2.50
Xylopia crinita	Annonaceae	Amazon	ENDO	4.65	6.50	33.00	15.50	71.98	2.50
Xylopia frutescens	Annonaceae	Amazon	ENDO	4.00	7.30	10.00	13.00	59.00	2.50
Xylopia nitida	Annonaceae	Amazon	ENDO	4.65	6.50	8.00	20.52	71.98	5.00
Xylopia ochrantha	Annonaceae	Amazon	ENDO	5.00	8.00	8.00	23.75	71.98	6.00
Xylopia parviflora	Annonaceae	Amazon	ENDO	5.00	8.00	8.00	20.52	155.92	2.50
Xylopia sp	Annonaceae	Amazon	ENDO	4.65	6.50	8.00	20.52	71.98	2.50
Xylopia spruceana	Annonaceae	Amazon	ENDO	4.65	6.50	8.00	32.79	71.98	2.50
Xylosma ciliatifolia	Salicaceae	Atlantic forest	ENDO	3.00	4.50	4.70	5.00	6.67	3.00
Zanthoxylum rhoifolium	Rutaceae	Amazon	ENDO	2.52	3.20	3.94	4.53	80.00	1.00

ARTIGO 2

Predicting and mapping tree dispersal traits across Brazilian biomes

Este artigo está formatado nas normas do periódico *Global Ecology and Biogeography*
(versão preliminar)

Predicting and mapping tree dispersal traits across Brazilian biomes

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Abstract

Aim: Here, we investigated the distribution of the main dispersal modes (endozoochory, synzoochory and anemochory) and seed mass for trees distributed across the four largest Brazilian biomes. We identified key ecological factors predicting their dominance and assessed them in the context of three hypotheses: disperser-availability, resource-availability, and recruitment-hypothesis.

Location: Brazilian biomes (Amazon, Atlantic Forest, Cerrado and Caatinga)

Time period: Vegetation inventories plots between 2004-2020.

Major taxa studied: Woody stems.

Methods: We assigned seed mass to 1, 984 species and dispersal mode to 2,202 species within 301 old-growth and non-flooded plots. We investigated the effects of climate, soil properties, and dispersal agents in predicting the proportion of the dispersal modes and community weighted means (CWM) of seed mass using random forest regressions.

Results: Our predictors explained up to 92% of the variation in the proportion of dispersal modes and in the dominance of seed mass. Climate emerged as the main driver, followed by soil or dispersal agents**.** Generally, communities under high water availability, low seasonality of precipitation and high temperature variations were dominated by endozoochory. Anemochory were prevalent under low water availability, high seasonality of precipitation and greater temperature variations and wind speed. Synzoochory were dominant in more stable temperatures. Heavy seeds were prevalent under high and stable temperatures, great precipitation levels, low wind speed and high soil bulk density.

Main conclusions: Climate, in terms of its variation and precipitation levels, plays a pivotal role in shaping both dispersal modes and seed mass distribution. We found support for the disperser-availability hypothesis in predicting the dominance of wind-dispersed tress, while the recruitment-hypothesis was important in predicting the dominance of heavy-seeded trees. Resource-availability hypothesis seems unlikely to explain the distribution of zoochory on a large scale. Further studies should consider variations in seed mass within dispersal modes, study scale, and the indirect impact of climate on soil fertility to gain a comprehensive understanding of the processes underpinning the dominance of dispersal modes in tropical ecosystems.

Keywords: Brazilian biomes, climate seasonality, climate change, dispersal modes, precipitation, mapping, random forest, seed mass, soil, wind speed

Introduction

One of the critical goals of large-scale studies in plant ecology is to identify the set of biotic and abiotic factors that shape plant functional traits (Moles et al., 2018). Although leaf and stem traits have been extensively studied across ecological gradients (Swenson & Enquist, 2007; Dwyer et al., 2014; Hernández-Calderón et al., 2014), dispersal traits have received less attention (expect seed size). These traits are crucial for multiple aspects along the plant regeneration process (Saatkamp et al., 2019). Specifically, seed size has known effects on seed production (Moles, 2018), dormancy (Rubio de Casas et al., 2017), seedling size, and survival (Westoby et al., 1996; Walters & Reich, 2000). Furthermore, the dispersal mode can indicate affinity to a specific dispersal vector (biotic or abiotic), influencing how seeds reach sites for survival, germination, and seedling establishment (Howe & Smallwood, 1982; Van der Pijl, 1982). For instance, seeds carried by biotic vectors have evolved nutritious tissues attracting frugivores that dispersed seeds inside their guts (endozoochory), whereas seeds and fruits bearing wings, plumes, kapok, or dust seeds are typically dispersed by the wind (anemochory) (Van der Pijl, 1982). Assessing the ecological factors that shape the seed size and dispersal mode distributions can help us understand how plant communities will respond to changes in climate, land use, or disperser communities. Climate and soil factors together have explained up to 50% of the variation in seed mass along the global spectrum of plant form and function (Joswing et al., 2022). Globally, seed mass and the proportion of zoochory increase from temperate to tropical regions and decrease from dry to humid forests (Westoby, 2002; Moles et al., 2007; Chen et al., 2017). At smaller scales, rainfall has consistently been associated with an increase in the proportion of zoochory and a decrease in the proportion of anemochory seeds (Tabarelli et al., 2003; Almeida-Neto et al., 2008; Correa et al., 2015, 2022). Although large-scale studies have found greater average seed mass under high levels of precipitation (Moles et al., 2007; 2014), studies in tropical and neotropical forests have reported insignificant relationships between seed mass and mean annual precipitation (Malhado et al., 2015; Pinho et al., 2021). Temperature has been both positively and negatively associated with seed mass in tropical forests (Malhado et al., 2015; Pinho et al., 2021). Large and synzoochorous seeds have been related to more stable climate, whereas small, endozoochory, and anemochory seeds have been associated with more variable climate (Malhado et al., 2015; Correa et al., 2015, 2022). Despite soil fertility being known to have a clear impact on plant growth, soil properties have not shown an independent effect in predicting seed mass along the global spectrum of plant form and function (Joswing et al., 2022). At the local scale, studies have shown negative relationships between seed mass and soil fertility (ter Steege et al., 2006). Furthermore, soil fertility in terms of cation exchange capacity and organic carbon density has been associated with a decrease in zoochory and an increase in anemochory (Correa et al., 2015, 2022). Overall, the relationships between seed mass and dispersal modes and ecological factors vary across different scales and contexts, and the main mechanisms explaining these patterns are not yet fully understood.

A set of non-mutually exclusive hypotheses have been suggested to explain the mechanisms underpinning patterns in dispersal mode and seed mass. The resource-availability hypothesis was proposed to explain the high metabolic costs involved in constructing and maintaining of fleshy fruits and large seeds compared to non-fleshy fruits and small seeds (Moles et al., 2007; Chen et al., 2017). Thus, the proportion of zoochorous trees is expected to increase in areas under high and constant air temperature and water availability from rainfall, as well as fertile soils. However, this hypothesis has been refuted due to inconsistencies of relationships between air temperature, climate seasonality, and soil fertility and dominance of dispersal modes (Correa et al., 2015, 2022). On the other hand, the disperser-availability hypothesis predicts that dispersal modes are associated with the availability of their dispersal agents. This hypothesis has received more support for anemochory and hydrochory dispersal modes, while results have been more mixed for zoochory when related to availability of frugivorous (Correa et al., 2015, 2022). Similarly, the recruitment hypothesis predicts that large seeds have a greater competitive advantage than small seeds by promoting higher seedling performance in shaded conditions associated with closed-canopy forests (Westoby et al., 1996; Eriksson et al., 2000; Walters & Reich, 2000). This hypothesis has been supported when associated with physical factors typically found in deeply shaded conditions such as warmer and less seasonal climates (Malhado et al., 2015; ter Steege et al., 2006). While higher seedling survival from large seeds is expected where sunlight is reduced, large seeds also tend to have a low dispersal potential without biotic or water intervention (Thomson et al., 2011). Thus, dispersal by animals and water plays a crucial role for heavy seeded-species, allowing transport far from the parental plant, avoiding negative density-dependent effects (Comita et al., 2014).

Despite the advance in understanding the distribution patterns of seed mass and dispersal modes and their ecological correlates, the lack of clear support for some hypotheses means there are still key gaps that require further investigation. Some of these gaps can potentially relate to the empirical data that has been analysed to date. For example, studies in tropical forest have focused on understanding the distributions of seed dispersal traits in moist forests, disregarding climate gradients associated with tree communities in savannas and seasonally dry forests (Almeida-Neto et al., 2008; Correa et al., 2015, 2022; Malhado et al. 2015). Additionally, there is a lack of congruence concerning the role of soil fertility in shaping seed dispersal traits across tropical ecosystems (Moles et al., 2018). Finally, the role of dispersers agents on seed dispersal traits across large scale assessments is still inconsistent (Correa et al., 2015, 2022).

To address these knowledge gaps, we assess the dominance of dispersal modes and seed mass across 301 old-growth vegetation plots. Specifically, we investigate the distribution of the most common dispersal modes and community weighted means of seed mass across the four largest Brazilian biomes. Brazil encompasses an impressive diversity of geological formations and vegetation types, featuring six officially recognized biomes (or phytogeographic domains). The four largest Brazilian biomes include the Amazon Forest, Atlantic Forest, Cerrado (Brazilian savanna) and Caatinga (seasonality tropical dry forest) (MMA, 2021). Furthermore, we ask which key ecological factors (including climate, soil proprieties, and dispersal agents) are shaping the dominance of the dispersal modes and seed mass. Across this broad geographic scale, we hypothesize that climate is probably the most important driver shaping the dominance of seed dispersal traits and, therefore, the focus on our predictions. If climate represents a prevailing force, we expect that high and stable levels of precipitation and temperature would be the main drivers for construction of zoochorous fruits and recruitment of large-seeded tress. We discussed the trends by considering the role of each driver group in predicting the dominance of seed dispersal traits and their implications in supporting ecological hypotheses. Finally, we stressed the implications of non-linear relationships between environmental drivers and seed dispersal traits in the face of changing environmental.

Methods

Study biomes and plots

We studied 301 plots distributed across the four largest Brazilian biomes – the Amazon (n=207), Atlantic Forest (n=29), Cerrado (n=36) and Caatinga (n=29) (Figure1). These plots were in non-flooded soils and old-growth vegetation. Plot inventories were carried out by a network of researchers who collected and recorded data on forest plots in the forestplots.net (Lopez-Gonzalez et al., 2011; ForestPlots.net et al., 2021). While other floristic data is available, the forest plots inventory has the advantage of standardising taxonomy, including information on plant size allowing us to define size criteria for inclusion, and describing the disturbance history of the sites allowing us to focus on undisturbed (or least-disturbed) forests. To ensure standardised species and families' nomenclature, we verified families, species and genera data using Flora do Brasil 2020 (Brazil Flora Group 2021).

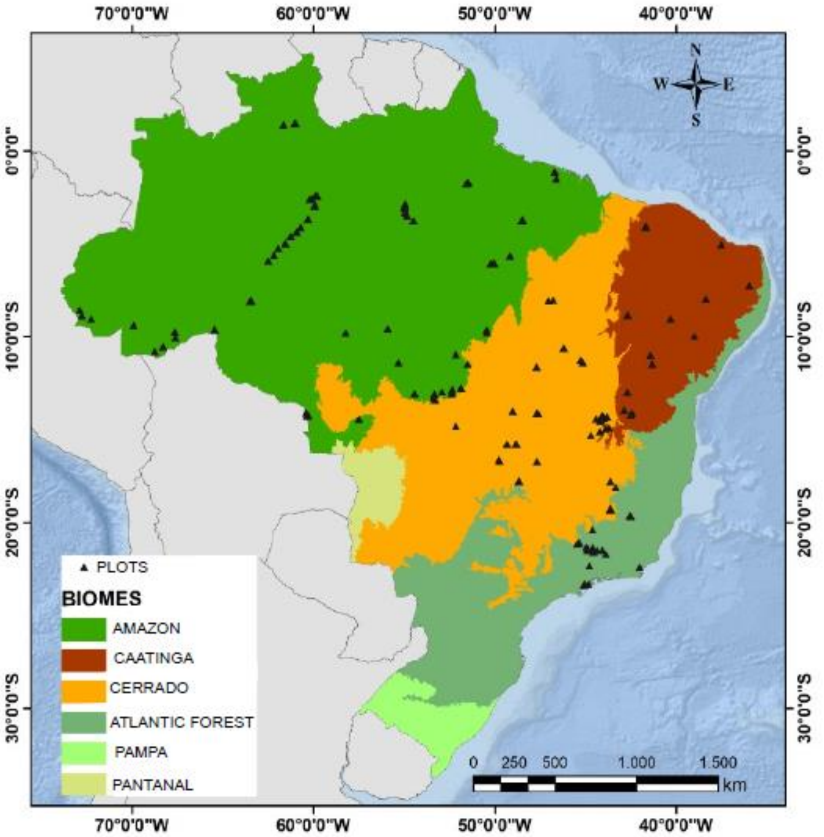

Figure 1: Localization of the 301 old-growth vegetation plots studied across the four largest Brazilian biomes: Amazon (n=207), Atlantic Forest (n=29), Cerrado (n=36), and Caatinga (n=29).

Vegetation data

We established the following criteria for the inclusion of woody stems. First, we considered only stems that in descending order corresponded to 80% of the accumulated abundance per plot. Second, we focused on woody stems from tree and shrub species (excluding herbaceous species, lianas, and bamboos). After established these main criteria, we applied distinct DBH thresholds for woody stems in each biome, following the methodological criteria established by vegetation inventories. Specifically, we included stems with a DBH ≥ 10 cm in the Amazon, ≥ 5 cm in the Atlantic Forest and Cerrado, and ≥ 3 cm in the Caatinga. Despite employing different DBH thresholds for moist forest biomes, this difference was insignificant considering our study scale (e.g., only 0.02% of total individuals from Atlantic Forest showed DBH ≤10 cm). From all these following steps, we could avoid potential bias by including non-woody plants to also ensure that the most representative woody species from each biome were represented in our dataset. Thus, we worked with a dataset that from 172,217 individuals belonging to 539 genera and 2,202 species.

Seed dispersal traits

We gathered information on the dispersal modes from a mix of sources, including scientific literature such as books, papers, and theses, as well as online databases (e.g., Seed Information Database-SID). Our classification divided species and morphospecies into two categories: zoochorous and non-zoochorous. Zoochorous species included endozoochorous and non-endozoochorous (synzoochory and myrmecochory) dispersal modes, while non-zoochorous species were classified according to anemochory, barochory, autochory, and hydrochory (see Table 1). We also applied the classification scheme proposed by Hawes and colleagues 2022, separating dispersal modes into sensu stricto and sensu lato categories. Sensu stricto referred to species or morphospecies with definitive dispersal modes, while sensu lato referred to those with two or more possible dispersal modes (see Table S1). In cases where there were no variations in dispersal modes (sensu stricto or lato) within species of the same genus, we assigned dispersal modes at the genus level.

Table1: Definition of dispersal modes following Hawes et al. (2022), Van Rosmallen (2013) and Kuhlmann & Ribeiro (2016)

Dispersal mode	Description
Endozoochory	Fleshy diaspores with small to large seeds dispersed through the gut of animals
Synzooochory	Fleshy or dry diaspores with large seeds carried externally through the body of bats, monkeys (primary dispersal) or scatter hoarders (secondary dispersal)
Myrmecochory	Dry diaspores with small seeds associated with a lipid-rich food body (elaiosome) carried by ants
Anemochory	Diaspores without fleshy structures carried by the wind

Barochory	Diaspores carried by gravity
Autochory	Dry diaspores carried by “itself” through explosive opening or elastic dehiscence (active autochory), or without any evident adaptation to specific dispersal agents (passive autochory).
Hydrochory	Diaspores without fleshy structures and floating abilities carried by water

We collected and compiled seed mass through scientific literature (books, scientific papers, and theses), global databases such as TRY Plant Trait Database (Kattge et al., 2020), BIEN Botanical Information and Ecology Network, and Seed Information Database (SID; Royal Botanic Gardens Kew, 2020) and personal communications. We prioritized the data compilation from dry seeds. However, in cases where dry materials were unavailable, we converted fresh mass to dry mass using a following correction factor: dry measurements = $[0.92 \times \text{fresh mass}]^{0.94}$ (Moles et al., 2005). In addition, we removed outliers from the entire data set by excluding values that exceeded the 90th percentile from the median of species in cases where the type of material (fresh or dry) was unknown. This approach allowed us to reduce the potential impact of measurement errors or inconsistencies on the data analysis.

We focused on seed mass data from endozoochorous, anemochorous, and synzoochorous species, as together represent a wide range of seed mass and account for 89% of the total number of individuals in our database (n= 152,501). Species and genus-level records were represented by a single value for seed mass, which is the median value of all records contained in our dataset. As seed size traits tend to be conserved along the phylogenetic tree (Fuzessy et al., 2021), we used the median trait values at the genus level for species with no trait information. For missing values for which no genus-level data were available, we used multivariate imputation with chained equations where each missing trait was imputed by a separate model using predictive mean matching (van Buuren & Groothuis-Oudshoorn, 2011). In general, as seed mass and dimensions are moderately to strongly correlated with each other, we used seed width and length to improve the accuracy of missing seed mass data (Souza, F.C., personal communication). The imputed trait data represented only 4.25% of the total number of individuals (n=152,501) and were broadly overlapped by the distribution of the observed datasets (Fig. S1).

Response variables

The organism's response to abiotic and biotic filters occurs through the dominance of traits directly influencing local communities' functional composition (Nock et al., 2016). To determine the dominance of seed mass, we calculated the community-weighted mean (CWM) of seed mass using abundance as the weighting factor as follows $CWM_{tp} = \sum^{s}_{i\text{-}1} AB_{ip} \text{ x } t_i$, where AB_{ip} is the relative abundance of species i in plot p and t_i, is the median trait value of species i (Muscarella et al., 2017). We used the median seed mass from each species and their values log-transformed (log +1) to reduce skewness in trait distributions. To determine the dominance of dispersal modes, we calculated the proportional abundance of the most common dispersal modes using the sum of the number of individuals per dispersal mode divided by the total number of individuals per plot. Although autochory was as representative as synzoochory, we did not include this dispersal mode because we are only interested in understanding how external dispersal agents could affect the distribution of seed dispersal traits. Thus, in this study, we considered as the most common dispersal modes only stems from endozoochorous, anemochorous and synzoochorous species (~90% of total individuals).

Explanatory variables

For each plot, we extracted monthly and annual mean data (1970-2000) from 19 bioclimatic variables from WorldClim version 2.0 (1km resolution) (Fick & Hijmans, 2017) and mean depth data (0-200 cm) from 10 soil variables obtained from SoilGrids version 2.0 (resolution of 250m) (Poggio et al., 2021). The descriptions and units of each climate and soil variable are summarized in Table S2.

To assess the role of biotic dispersal agent on seed dispersal traits, we used the potential biomass of primates' species as a proxy for the biomass of all frugivorous animals. Primates are one of the largest arboreal vertebrates, constituting a great proportion of frugivore biomass in tropical forests (Haugaasen & Peres, 2005). To calculate the total biomass of frugivorous primate species in each plot, we first obtained the primate species lists in each georeferenced localization through polygons of species distribution available by International Union for Conservation of Nature (IUCN). We then conducted a search to gather information about the proportion of fruit in the diet of each primate species, and subsequently classified them based on their level of frugivory using EltonTraits (Wilman et al., 2014). To avoid occasional frugivores (<20% of fruits in the diet), we considered only those species of primates with a primary (>50%) or secondary (20%<50%) frugivory degree. In addition, we excluded records of *Pitheciid* genera (*Callicebus*, *Cheracebus*, and *Pithecia*), which are medium-to-large primates that primarily act as seed predators rather than seed dispersers (Hawes & Peres, 2014; Fuzessy et al., 2021). We then compiled the body mass of each frugivorous primate species from EltonTraits database (Wilman et al., 2014) and calculated the interquartile range (IQR) biomass of primates per plot. The IQR is a measure of variability that is not affected by outliners values or skewed distributions, representing the values within the middle 50% of the data distribution (Q3-Q1). Therefore, we use the IQR as a reliable measure of the functional breadth of seed dispersers in each plot. Finally, to assess the role of abiotic dispersal agent on the dominance of anemochory, we obtained annual mean wind speeds (10m-200m above ground) for each plot from the Global Wind Atlas maps at 250m resolution.

Data analysis

We compared the proportional abundance of each dispersal mode and the community-weighted mean (CWM) of seed mass across biomes using generalized linear models (GLMs) with quasi-binomial distribution for proportional data and Gaussian distribution for continuous data. Post-hoc tests were conducted using *emmeans* function to assess differences in the proportion of each dispersal mode category and CWM values across biomes (Lenth, 2023).

We trained Random Forest (RF) models to predict the proportional abundance of the most common dispersal mode and CWM of seed mass. RF is a robust machine learning algorithm that combines multiple decision trees to make predictions for both regression and classification tasks. For each decision tree, the algorithm uses the method of bootstrap aggregating (bagging). First, the algorithm selects random sample data from the original dataset (bootstrap dataset) and then a random subset of variables for each tree. Predictions are made by averaging the outcomes of all individual trees. Thus, this procedure helps avoid overfitting (common in decision tress) and minimizes multicollinearity caused by high correlations between some predictors (Breiman, 2001).

To identify the most important and less redundant climate and soil variables for our prediction's models, we established the following steps. Firstly, we created separate models for each soil and climate groups (temperature, precipitation, chemical and physical soil variables). After created each model, we calculated %IncMSE (percent increase in mean squared error) to assess the importance of each variable by model. This metric calculates the percentage reduction in model mean squared errors when a variable is removed compared with error total when all variables are included (Breiman, 2001). Next, we focused on the most important variables by excluding those with a %IncMSE value lower than the overall mean. Additionally, to avoid the inclusion of highly redundancy climate and soil predictors and keep the most crucial ones in final models, we ranked all variables in descending order of importance and examined the correlation coefficients between them. We then excluded variables that were highly correlated with each other (ρ>0.85) following their order of importance ranking. We maintained dispersal agents as predictors in all our models as they exhibited no strong correlation with the most important climate and soil variables. By applying all these steps, we obtained final models including only the most informative and less redundant variables, which are essential for interpreting the importance metrics (Table S3).

To optimize the performance of our models and minimize overfitting, we used a hyperparameter tuning process with five-fold cross validation (Kuhn & Johnson, 2013). To find the best hyperparameters, we explore a set combination of hyperparameters, including number of trees (ntree: 50 to 300 by 20), number of variables as candidates at each split (mtry: 3 to maximum number of variables by 1) and size of terminal nodes (nodesize: 5 to 20 by 2). For each combination of hyperparameter, we trained RF models using four folds as the training set, while the remaining one was allocated as the testing set. This iterative process was repeated until each fold had served as a testing set. To evaluate the performance of each model, we calculated the root-mean-squared error (RMSE) using the testing dataset and selected as the best model the set of hyperparameters with the lowest RMSE. We then trained the best model using the full dataset to make predictions.

To create prediction maps for each response variable, we constructed a raster stack comprising all the variables used in the model at a grid resolution of 0.0417º x 0.0417º. We obtained single raster from soil, climate, and wind speed variables from the WorldClim and SoilGrids spatial sources. To obtain a raster of primate biomass, we created a raster for each primate species with biomass values corresponding to the polygons. Then, all the species rasters were stacked into a single raster object, and the interquartile range (IQR) of biomass values in each cell was calculated. From all the single raster created and stacked, we used them to predict the proportional abundance of zoochory and CWM of seed mass.

All analyses were conducted using the R software version 4.3.1 (R Core Team, 2023). The collinearity among predictor variables was assessed using the '*corrplot*' package. The

CWM seed mass values were calculated using the *'functcomp'* function from the 'FD' R package (Laliberté & Legendre, 2010). Multivariate trait imputation was carried out using the '*mice*' package (van Buuren & Groothuis-Oudshoorn, 2011). Post-hoc tests were performed using the '*emmeans*' package (Lenth, 2023). The 'caret' package was used to split the data into training and test sets using k-fold cross-validation. Random forest models were trained using the *'randomForest'* package. Finally, the *'raster'* and *'rgdal'* packages were used to read, write, manipulate, and create spatial data.

Results

Dispersal modes and seed mass distributions

Endozoochory was the most representative dispersal mode in terms of number of individuals, followed by anemochory, autochory and synzoochory (Table S4). The proportion of endozoochory was highest in the Atlantic Forest compared to other biomes. Anemochory was more predominant in the Cerrado and Caatinga than in the Amazon and Atlantic Forest. The proportion of synzoochory were greater in the Amazon than in Atlantic Forest, Cerrado, and Caatinga. Autochory were more frequent in the Caatinga than in the other biomes. The less representative dispersal modes were presented in more details in Table S4. Concerning seed mass, CWM values were significantly higher in the Amazon when compared to the Atlantic Forest, Cerrado, and Caatinga (Figure 2).

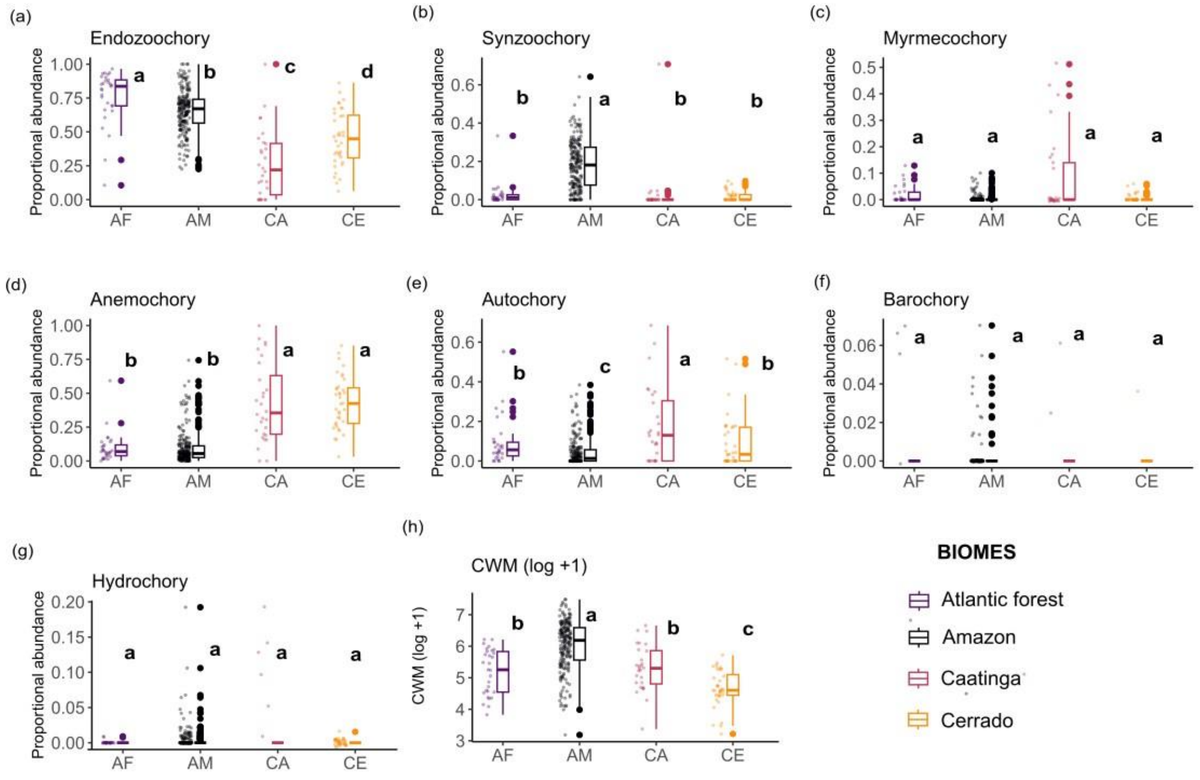

Figure 2: Differences between biomes (Atlantic forest-AF, Amazon-AM, Caatinga-CA, and Cerrado-CE) in the proportional abundance of endozoochory (a), synzoochory (b), myrmecochory (c), anemochory (d), autochory), barochory (f), hydrochory (g), and CWM of seed mass. Jittered points are the actual values, boxplot (centre line), 25–75% quartiles (box edges), < 1.5 times the interquartile range (whiskers), and extreme values (dots).

Predicting the ecological factors shaping dispersal modes and seed mass across Brazilian biomes

Dispersal modes

Predictors explained 91% and 83% (sensu stricto) of the variation in the proportion of endozoochory. The most important predictors were associated with climatic variations, availability of water from rainfall, and soil pH (Figure 3a-d). Generally, the proportion of endozoochory decreased with increasing seasonality of precipitation, pH and isothermality and increased with increasing temperature annual range (Figure 3b). Similarity, variables associated with climatic variations along the annual precipitation were the most important factors in predicting the proportion of endozoochory sensu stricto (Figure 3c). Thus, endozoochory sensu stricto decreased with increasing seasonality of precipitation and isothermality and increased with increasing annual precipitation and temperature annual range (Figure 3d; Figure 5a, d).

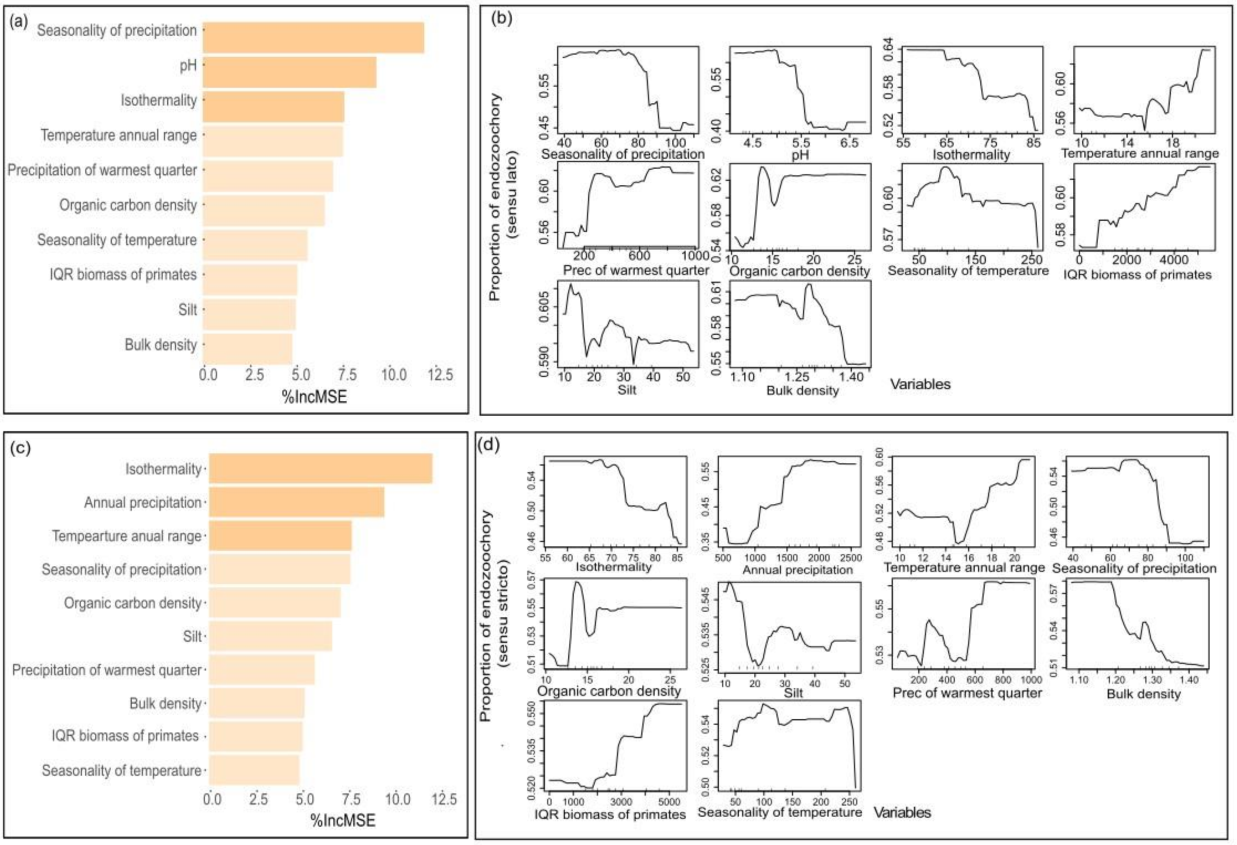

Figure 3: Predictions on the proportional abundance of endozoochory from random forest regressions. The importance of climate, soil and dispersal agents in predicting the proportion of theendozoochory (sensu stricto and lato) (a) and endozoochory sensu stricto (c) using the percent increase in mean squared error (%IncMSE). The most important predictors (%IncMSE > overall mean) are highlighted with dark colours. The partial dependence plots show the mean marginal influence of each explanatory variables on the proportional abundance of endozoochory (b) and endozoochory sensu stricto (d) while all the other predictors remained constant at their sample mean.

Predictors explained 83% and 82% (sensu stricto) of the variation in the proportion of synzoochory. Specifically, predictors related to temperature variation were the most important (Figure 4a-b). Overall, the proportion of synzoochory decreased with increasing seasonality of temperature and mean diurnal temperature range and increased with high levels of isothermality (Figure S3a). Regarding the synzoochory sensu stricto, we found that seasonality of temperature remained as important predictor, along soil pH and precipitation of wettest quarter (Figure 4b). The proportion of synzoochory sensu stricto decreased with increasing temperature seasonality but showed inconsistent relationships with precipitation of the wettest quarter and soil pH (Figure S3b; Figure 5b; e).

Our predictors explained 92% and 90% (sensu stricto) of the variation in the proportion of anemochory. Among these predictors, climate and dispersal agent were the most influential in determining the proportion of anemochory (Figure 4c-d). Precipitation of wettest quarter showed a negative relationship with anemochory levels, while mean annual wind speed and mean diurnal temperature range exhibited a rapid exponential increase, followed by small oscillations (Figure S3c). Similarity, climatic variation, and wind speed were the most important ecological factors in predicting the proportion of anemochory sensu stricto (Figure 4d). The proportion of anemochory sensu stricto increased with increasing seasonality of precipitation but show irregular trends with increasing isothermality. On the other hand, mean annual wind speed remained consistent with the trends observed previously (Figure S3d); Figure 5c-f).

Seed mass

Predictors explained 83% of the variation in seed mass, with climate, soil, and wind speed standing out as the most important (Figure 4g). Seed mass was positively associated with high mean precipitation in the driest quarter and temperature in the wettest quarter. Generally, seed mass showed an exponential decrease with increasing mean diurnal temperature range and seasonality of temperature. Additionally, increasing soil bulk density was associated to high dominance of heavy seeds (Figure S4; Figure 5g).

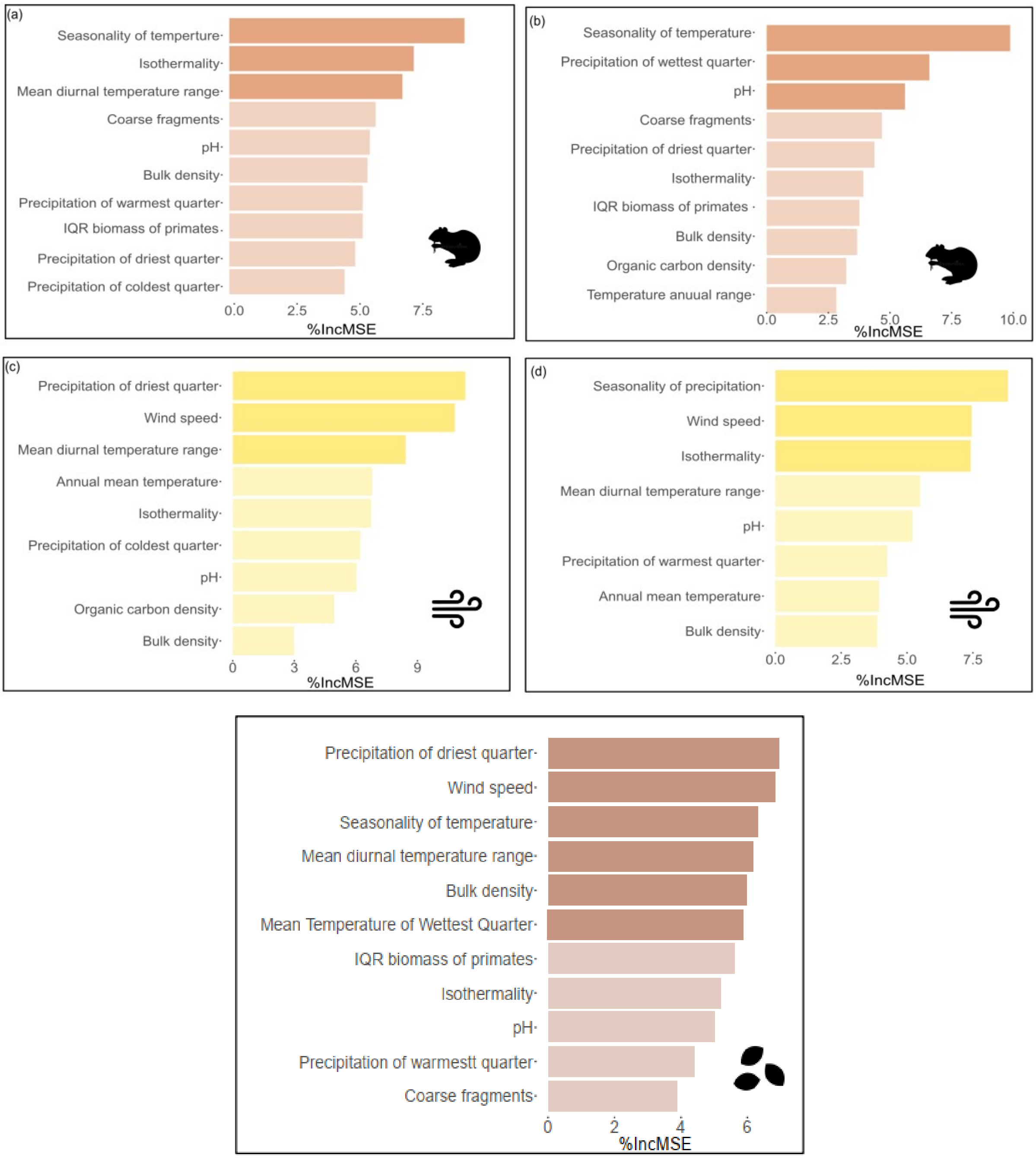

Figure 4: Importance of each explanatory variables in predicting the proportional abundance of synzoochory, anemochory and community weighted means (CWM) of seed mass using abundance as the weighting factor. The proportional abundance of synzoochory and anemochory is represented in both sensu lato (a,c) and stricto categories (b,d). The importance of all predictors is represented by the percent increase in mean squared error (%IncMSE), with the most important ones (%IncMSE > overall mean) highlighted using dark colours.

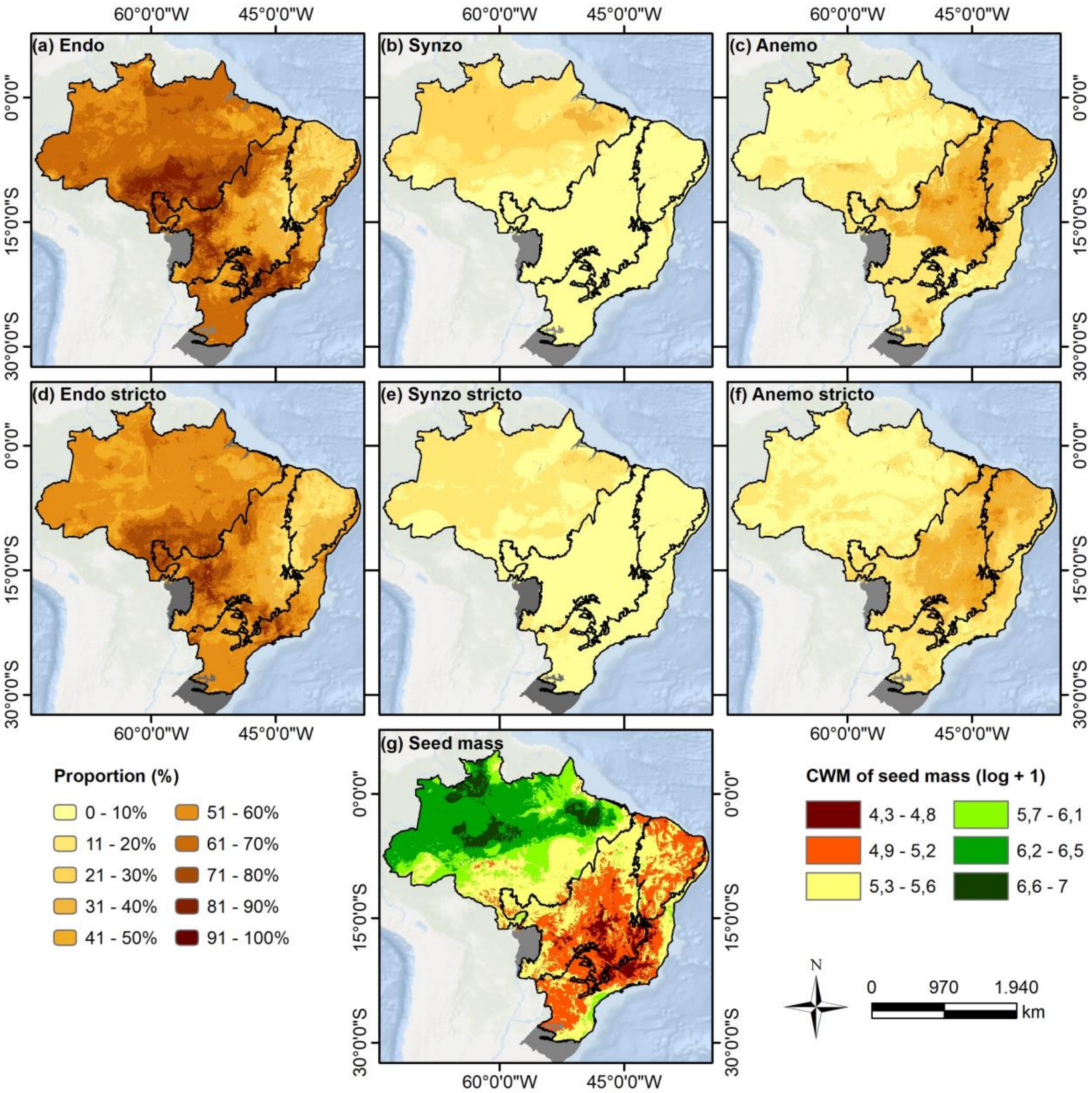

Figure 5: Prediction map of the proportion of each dispersal mode categories and community weighted means (CWM) of seed mass based on climate, soil and dispersal agents using random forest regression across the largest Brazilian biomes. Light yellow colour indicates a low proportion of dispersal modes, while dark brown colour represents a high proportion (a-f). On the seed mass map (g), red colour indicates low values CWM, while dark green colours represent high values of CWM on a logarithmic scale.

Discussion

Our large-scale assessment shows the important role of climate in shaping the seed dispersal traits across Brazilian biomes. Specifically, predictors related to climate variations and water availability from rainfall were the most important for predicting the dominance of seed dispersal traits following by soil properties or dispersal agents. Our findings also highlight the importance of considering non-linear trends to predict plant functional traits across large-scale ecological gradients, with implications for plant response in the face of environmental change. Additionally, our study providing insights on the mechanisms underpinning the dominance of seed dispersal traits across Brazilian biomes.

The role of climate in shaping seed dispersal traits

At a local-scale, animal-dispersed trees have been associated with high and stable water availability from rainfall whereas wind-dispersed trees have been related to low and unstable precipitation levels (Tabarelli et al., 2003; Almeida et al., 2008., Correa et al., 2015, 2022). Our results support this, demonstrating that endozoochorous and synzoochorous seeds were dominant under high levels of precipitation. However, contrary to recent findings in the Amazon (Correa et al., 2022), our study showed a high dominance of endozoochory and low dominance of anemochory under lower seasonality of precipitation. This difference between studies may reflect the greater range in precipitation in our cross-biome assessment, showing that within biome patterns may not necessarily reflect larger-scale relationships.

Plant traits have been frequently related to favourable conditions during the growing season rather than the least favourable period of the year (Chen et al., 2017; Moles, 2018). However, our findings suggest different scenario for seed mass and wind-dispersed species, as precipitation during the driest part of the year played a crucial role in predicting the dominance of anemochory and heavy seeds. Species bearing large seeds could have a differential advantage in surviving during challenging periods of the growing season by providing sufficient resources for early seedling establishment (Moles et al., 2018). On the other hand, wind-dispersed species could have a selective advantage in reproducing during the least favourable period of the year by producing many offspring (Moles, 2018). In addition, less favourable climatic conditions may reflect the fruiting and dispersal phenology of wind-dispersed species, which commonly occur in the dry season (Griz & Machado, 2001; Hawes & Peres et al., 2016;

Escobar et al., 2018). This period could provide the necessary and consistent dryness for non-fleshy fruits (e.g., anemochorous) to release their seeds (Chen et al., 2017).

Wind-dispersed seeds have been linked to environments under high temperature variations, whereas animal-dispersed seeds have been associated with both stable and unstable temperatures (Correa et al., 2020). Our study supports these findings, as anemochory and endozoochory were dominant in environments under high temperature variation, while synzoochory was dominant under more stable temperature. These trends can be better understood from the perspective of seed size. The low uniformity and greater temperature variation could favour the dominance of small-seeded (many of them anemochorous and some endozoochorous) trees, which seeds are more likely to exhibit dormancy and survive adverse seasonal conditions (Rubio de Casas et al., 2017; Pinho et al., 2021). Conversely, synzoochorous seeds are typically associated with large-seeded trees, and large seeds are known to have greater recruitment success than small seeds in shady environments under stable climates (Eriksson et al., 2000; Walters & Reich, 2000), mainly among community trees near the equator (Pinho et al., 2021). Indeed, heavy seeds had higher dominance in warmer environments under low temperature variations (seasonal and diurnal), reaching their peak in the core regions of the Amazon.

The role of soil properties in shaping seed dispersal traits

After climate, soil variables had the next strongest influence on dispersal traits. Indeed, soil pH was the second most important variable for endozoochory and the third most important for synzoochory. This strong role of soil is interesting, but the mechanism remains unclear. Overall, essential mineral nutrients for photosynthesis rates tend to be lowest in acidic soils, but their direct effect on dispersal modes is still unknown (Maire et al., 2015). Although soil pH is recognized as an essential factor for soil fertility, its dynamics are affected mainly by broad-scale climate gradients (Joswig et al., 2022). Soil pH is known to decrease from arid climates to humid climates, with abrupt changes from alkaline to acidic soil occurring where annual precipitation starts to exceed potential evapotranspiration (positive water balance) (Slessarev et al., 2016). These differences in water balance and thus in soil acidity may be related to our cross-biome assessment. Considering this potential mechanism, moist forests could show high levels of endozoochory under low pH due to a more stable water balance provided by high levels of precipitation during the year and low total evapotranspiration. However, dry forests could show a decrease in endozoochory under high pH, as evapotranspiration demand exceeding precipitation (negative water balance). In turn, savanna regions may be considered transition regions where high levels of endozoochory could still be present under slightly acidic soils provided by different conditions of water balance from adjacent biomes (moist forest and dry forest) (Figure S5).

Bulk density is a crucial soil property due to its effects on concentrations and fluxes of soil elements with known effects on leaf traits (Maire et al., 2015). However, their direct effects on seed mass are also unknown. High levels of soil compaction can make it difficult for organic carbon stocks to be transported, as well as to uptake them by roots in the deeper soil layers (Bernoux et al., 1998; Weil & Brady, 2017). In addition, coarse-textured soils such as sandy soils have higher bulk density than silt and clay soils (Weil & Brady, 2017). These effects of soil compaction can lead to more infertile soils or difficult the uptake of nutrients to plant roots, difficulty in initial development of seedlings. However, it is reasonable to expected that large seeds with their high nutritional reserves may cope with poor soils by producing large seedlings with high survival rates in the early stage of recruitment (ter Steege et al., 2006; Moles, 2018).

Despite the influence of soil pH and bulk density, it is important to point out that local-scale variation in soil properties is generally large. Thus, a coarse-scale soil database could not effectively capture the fine-grained variations in soil properties, such as nutrient supply. In turn, soil acidity, which often indicates climate variations on a large-scale (Maire et al., 2015; Joswig et al., 2022), was selected as an important variable in almost all models and had greater importance in predicting the dominance of zoochory.

The role of dispersal agents in shaping seed dispersal traits

Beyond climate and soil factors, the role of dispersal agents on seed dispersal traits have been recently investigated in tropical forest (Correa et al., 2015, 2022). Our cross-biome assessment supports some of these findings, as anemochory and light-seeded tress were dominant in communities under higher wind speed. However, animal dispersal agents in terms of biomass of primates had lower impact in predicting the dominance of zoochory and heavy-seeded tress. Generally, animal body size is related to the amount of fruit intake (Fuzzey et al., 2021). Thus, a wide range of body mass of primates across communities could indicate complementary roles on plant-frugivorous interactions, increasing the chances of a fruit-consuming vertebrate to act as a disperser of large-seeded fleshy fruits. However, our analyses suggest that the IQR of biomass of primates was not of great importance in predicting the dominance of zoochory and seed mass. This measure has limitations by not considering neither the extant primate's distribution nor its relative abundance across communities. Since the plant-frugivorous interactions normally occur in small-grain scale, values of primate's community at the respective plant trait sites could be a functionally more realistic to investigate the role of frugivore availability on seed dispersal traits. Additionally, the dominance of zoochory and large seeds may be affected by the biomass of other specialized disperser groups, such as birds, bats, and scatter-hoarders. For instance, scatter-hoarders' rodents could play a significant role in predicting the dominance of synzoochory and heavy seeds while flying frugivores such as birds and bats could have a greater impact on seed dispersal in communities with semi-open woodland vegetation (Eriksson et al., 2016; Mittelman et al., 2021).

Although we investigated the role of frugivorous biomass in the dominance of animal-dispersed species, the dominance of animal-dispersed trees could be also an important driver of frugivorous primates' biomass (Stevenson, 2015). These effects could introduce positive feedback where changes in the availability of animal-dispersed trees would positively impact the biomass of primates through the production of nutritional fruits, and those high availability of primates through seed dispersal would lead to greater recruitment of zoochorous trees. Unravelling the role of frugivorous animals is essential given that the loss or decrease of large-frugivorous biomass can affect the recruitment of large-seeded tress, especially those dispersed by primates, with consequent impacts on forest carbon stocks (Bello et al., 2015; Gardner et al., 2019).

What these factors meaning for the ecological hypothesis?

Consistent with previous studies, our findings were not fully supported resource-availability hypothesis for the proportional abundance of the most common dispersal modes (Correa et al., 2015, 2022). Although endozoochory was positively associated with high and stable water availability, we observed positive relationships with more variable temperature (low isothermality and high temperature annual range) and low fertility soils in terms of pH. As predicted by this hypothesis, synzoochory showed positive relationships with more stable temperatures (high isothermality, low mean diurnal range and seasonality) but did not show clear trends with precipitation and soil fertility. Still, air temperature was not considered as an important factor for the dominance of dispersal modes. Finally, according to predictions, anemochory was associated with low water availability (in the driest part of the year), and unstable climate (high mean diurnal temperature range and seasonality of precipitation). However, soil proprieties related to fertility were not of great important in predicting the dominance of wind-dispersed trees.

According to disperser-availability hypothesis, our analyses showed that disperser-availability hypothesis was well-supported for wind-dispersed species. There are many reasons to expect the dominance of zoochory trees could change along frugivorous fauna gradients. For instance, macroevolutionary studies have shown strong evidence that interactions between fleshy-fruited angiosperms and modern primates were shaped by coevolution at both local and continental scales (Fuzessy et al., 2021). However, our analyses show that disperser-availability hypothesis was not supported for animal-dispersed species using IQR of primate biomass as a proxy for functional breadth of frugivorous animals. Likewise, recent studies in the Amazon have no found support for the disperser-availability hypothesis using the biomass of frugivorous primates (Correa et al., 2022). However, studies in neotropical forests have found support for the disperser-availability hypothesis using the biomass of primates at respective plant sites without accounting for variables related to resource availability in a single model. Based on these pieces of evidence, it is also possible that frugivorous dispersal agents assume a secondary role when examined together with large-scale gradients in climatic factors (Correa et al., 2015).

Our findings support the recruitment-hypothesis, as heavy seeds were dominant under conditions typically found in deeply to moderately shaded environments. These conditions include high temperatures during the wettest quarter, low temperature variations (both seasonal and diurnal), and greater precipitation levels in the driest quarter. Although our findings were based on plot-level data, they are consistent with results obtained from species occurrence data across spatial grid-cells in tropical moist forest (Malhado et al., 2015). This congruence suggests that climate plays a crucial role in shaping both regional species pools and local changes in trait dominance. Beyond shade conditions, bearing larger seeds could be an advantageous trait in soils under high bulk density, which is strongly related to poor tropical soils in terms of organic carbon (Bernoux et al., 1998). Indeed, changes in soil fertility have well-known effects on forest dynamic, influencing the productivity and turnover of individuals in tropical forest. Thus, a lower turner of individuals in lower-nutrient soils (e.g., compact soils with low resources) could favour the recruitment of large seeds, which commonly present highly competitive advantage under low disturbance rates (ter Steege et al., 2006).

The importance of non-linear relationships between environmental drivers and seed dispersal traits

Many of the relationships between seed dispersal traits and environmental factors exhibited abrupt change points. These abrupt changes in ecological systems occur rapidly relative to their drivers, particularly those associated with extreme environmental conditions (Turner et al., 2020). Thus, detecting these sharp shifts could be crucial for understanding how plants respond to ongoing environmental changes. For instance, it is expected that global warming will increase climate instability in tropical forest through the increase of seasonality of precipitation and intensification of the annual hottest day temperature and wettest day precipitation (IPCC, 2023). As a result, larger-seeded species may experience an abrupt decrease in successful recruitment due to shifts to more variable temperature, while small-seeded species could potentially benefit from such conditions. Similarly, it is reasonable to expect that communities dominated by wind-dispersed seeds may be able to naturally adapt to unstable climate. Still, ecotones regions (e.g., savannas and forests), where sensitivity to climate change tend to be greatest, and response faster, could have a major impact on the dominance of endozoochory in the face of high seasonality of precipitation predicted by global warming.

Conclusions

Understanding the main abiotic and biotic factors that influence tree dispersal traits is crucial to unravel the drivers for plant recruitment in the face of a changing world. Our findings suggest that climate plays a pivotal role in shaping both dispersal modes and seed mass distribution across the four largest Brazilian biomes. The resource-availability hypothesis was not well-supported, even when considering wide soil and climate gradients and non-linear approaches for trait-environment relationships. These results highlight that new hypotheses are needed to develop a more complete understanding of the processes that underpin the dominance of zoochory across tropical ecosystems. These hypotheses should consider variation in seed size within dispersal modes, changes in vegetation type within and across biomes, scale of study, and the indirect influence of climate on soil fertility. On the other hand, the distribution of wind-dispersed species can be predicted by considering the mean annual wind speed (disperser-availability hypothesis), while heavy-seeded species could increase in more shade environments and poor soils in terms of bulk density (recruitment hypothesis). Advancements in large-scale plant ecology are needed to further understand the mechanisms underlying the relationships between frugivores and the dominance of animal-dispersed species. Finally, our findings reveal numerous non-linear trait-environment relationships, which could be important to consider when predicting shifts in plant responses to ongoing environmental change.

Acknowledgements

We are grateful to the UK Natural Environment Research Council (NE/S011811/1) for financial support. FCS would like to thank the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior – Brasil (CAPES) – Finance Code 001 for the PhD scholarship. We are deeply thankful for everyone involved in field collection, identification, and data curation from vegetation inventories. We also thank all Brazilian herbarium collections for providing and organizing online materials. This publication is based on Research Project number 98 of the ForestPlots.net global collaboration 'Mapping reproductive traits across South American biomes'.

Data Accessibility Statement

The proportion of each dispersal modes categories and community weighted means of seed mass (CWM) per plot are included as Supporting Information (APPENDIX II).

References

Almeida-Neto, M., Campassi, F., Galetti, M., Jordano, P., & Oliveira-Filho, A. (2008). Vertebrate dispersal syndromes along the Atlantic Forest: Broad-scale patterns and macroecological correlates. *Global Ecology and Biogeography, 17*, 503–513.

Bello, C., Galetti, M., Pizo, M. A., Magnago, L. F. S., Rocha, M. F., Lima, R. A., Peres, C. A., ... Jordano, P. (2015). Defaunation affects carbon storage in tropical forests. *Science Advances*, *1*, e1501105.

Bernoux, M., Cerri, C., Arrouays, D., Jolivet, C., Volkoff, B. (1998). Bulk Densities of Brazilian Amazon Soils Related to Other Soil Properties. *Soil Science Society of America Journal, 62*, 743-749.

Brazil Flora Group (2021). Brazilian Flora 2020 project - Projeto Flora do Brasil 2020. v393.274. Instituto de Pesquisas Jardim Botanico do Rio de Janeiro. Dataset/Checklist. Available from: http://floradobrasil.jbrj.gov.br/

Breiman, L. (2001). Random Forests. *Machine Learning*, *45*, 5–32.

Chen, S. C., Cornwell, W. K., Zhang, H. X., & Moles, A. T. (2017). Plants show more flesh in the tropics: Variation in fruit type along latitudinal and climatic gradients. *Ecography*, *40*, 531–538.

Correa, D. F., Álvarez, E., & Stevenson, P. R. (2015). Plant dispersal systems in neotropical forests: Availability of dispersal agents or availability of resources for constructing zoochorous fruits? *Global Ecology and Biogeography, 24*, 203–214.

Correa, D. F., Stevenson, P. R., Umaña, M. N., Coelho, L. d. S., Lima Filho, D. d. A., Salomão, R. P., … ter Steege, H. (2023). Geographic patterns of tree dispersal modes in Amazonia and their ecological correlates. *Global Ecology and Biogeography*, *32*, 49–69.

Comita, L. S., Queenborough, S. A., Murphy, S. J., Eck, J. L., Xu, K., Krishnadas, M., … Gómez-Aparicio, L. (2014). Testing predictions of the Janzen–Connell hypothesis: A meta-analysis of experimental evidence for distance-and density-dependent seed and seedling survival. *Journal of Ecology*, *102*, 845– 856.

Dwyer, J. M., Hobbs, R. J., & Mayfield, M. M. (2014). Specific leaf area responses to environmental gradients through space and time. *Ecology*, *95*, 399–410.

Escobar, D.F.E., Oliveira, F.A.O., Morelatto, L.P.C. Timing of seed dispersal and seed dormancy in Brazilian savanna: two solutions to face seasonality. (2018). *Annals of Botany*, *121*, 1197–1209.

Eriksson, O., Friis, E.M. & Löfgren, P. (2000). Seed size, fruit size, and dispersal systems in angiosperms from the Early Cretaceous to the Late Tertiary. *American Naturalist, 156*, 47–58.

Fick, S. E., & Hijmans, R. J. (2017). Worldclim 2: New 1-km spatial resolution climate surface for global land areas. *International Journal of Climatology, 37*, 4302-4315.

Fuzessy, L., Silveira, F.A.O., Culot, L., Jordano, P. & Verdu, M. (2021). Phylogenetic congruence between Neotropical primates and plants is driven by frugivory. *Ecology Letters*, *25*, 320–325.

ForestPlots.net., Blundo, C., Carilla, J., Grau, R., Malizia, A., Osinaga-Acosta, O., Bird.M., Bradford, M. et al. (2021) Taking the pulse of Earth's tropical forests using networks of highly distributed plots. Biological Conservation, 260, 1–27.

Gardner, C.J., Bicknell, J.E., Baldwin-Cantello, W., Struebig, M.J., & Davies, Z.G. (2019). Quantifying the impacts of defaunation on natural forest regeneration in a global meta-analysis. *Nature Communications, 10*(4590),1–7.

Griz, L. M. S., & Machado, I.C.S. 2001. Fruiting phenology and seed dispersal syndromes in caatinga, a tropical dry forest in the northeast of Brazil. *Journal of Tropical Ecology*, *17*, 303–321.

Haugaasen T., & Peres C.A. (2005). Mammal assemblage structure in Amazonian flooded and unflooded forests. *Journal of Tropical Ecology*, *21*, 133–145.

Hawes, J.E., & Peres, C.A. (2014). Ecological correlates of trophic status and frugivory in neotropical primates. *Oikos, 123*, 365–377.

Hawes, J.E., & Peres, C.A. (2016). Patterns of plant phenology in Amazonian seasonally flooded and unflooded forest. *Biotropica*, *48*, 465–475.

Hawes, J., Vieira, I., Magnago, L., Berenguer, E., Ferreira, J., Aragão, L., Cardoso, A., Lees, A., Lennox, G. et.al. (2020). A large-scale assessment of plant dispersal mode and seed traits across human-modified Amazonian forests. *Journal of Ecology*, *108*, 1373-1385.

Hernández-Calderón, E., Méndez-Alonzo, R., Martínez-Cruz, J., González-Rodríguez, A., & Oyama, K. (2014). Altitudinal changes in tree leaf and stem functional diversity in a semi-tropical mountain. *Journal of Vegetation Science, 25,* 955–966.

Howe, H. F., & Smallwood, J. (1982). Ecology of seed dispersal. *Annual Review of Ecology and Systematics, 13*, 201–228.

IPCC (2023). *Climate Change 2023: Synthesis Report. A Report of the Intergovernmental Panel on Climate Change. Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* [Core Writing Team, H. Lee and J. Romero (eds.)]. IPCC, Geneva, Switzerland.

Joswig, J.S., Wirth, C., Schuman, M.C., Kattge, J., Reu, B., Wright, I.J., … Mahecha, M.D. (2022). Climatic and soil factors explain the two-dimensional spectrum of global plant trait variation. *Nature Ecology and Evolution, 6*, 36–50.

Kattge, J., Bönisch, G., Díaz, S., Lavorel, S., Prentice, I. C., Leadley, P., …Wirth, C. (2020).

TRY plant trait database - enhanced coverage and open access. *Global Change Ecology*, 26, 119–188.

Kuhn, M., & Johnson, K. (2013). Applied Predictive Modeling, Germany, Springer: Berlin/Heidelberg.

Lenth, R. (2023). emmeans: estimated Marginal Means, aka Least-Squares Means.

Lopes-Gonzalez., Lewis, S.L., Burkitt, M., Baker, T.R. & Phillips, O.L. (2011). ForestPlots.net: a web application and research tool to manage and analyse tropical forest plot data. *Journal of Vegetation Science, 22*, 610-613.

Maire, V., Wright, I. J., Prentice, I. C., Batjes, N. H., Bhaskar, R., Bodegom, P. M., … Ordonez, A. (2015). Global effects of soil and climate on leaf photosynthetic traits and rates. *Global Ecology and Biogeography*, *24*, 706–717.

Malhado, A., Oliveira-Neto, J. A., Stropp, J., Strona, G., Dias, L. C., Pinto, L. B., & Ladle, R. J. (2015). Climatological correlates of seed size in Amazonian Forest trees. *Journal of Vegetation Science*, *26*, 956–963.

Mittelman, P., Dracxler, C.M., Santos-Coutinho, P.R.O., Pires, A.S. (2021). Sowing forests: a synthesis of seed dispersal and predation by agoutis and their influence on plant communities. Biological Reviews, *96*, 2425–2445.

Moles, A. T., Ackerly, D. D., Webb, C. O., Tweddle, J. C., Dickie, J. B., Pitman, A. J., & Westoby, M. (2005). Factors that shape seed mass evolution. *Proceedings of the National Academy of Sciences of the United States of America*, *102*(30), 10540–10544.

Moles, A. T., Ackerly, D. D., Tweddle, J. C., Dickie, J. B., Smith, R., Leishman, M. R., …Westoby, M. (2007). Global patterns in seed size. *Global Ecology and Biogeography, 16*, 109–116.

Moles, A. T., Perkins, S. E., Laffan, S. W., Flores-Moreno, H., Awasthy, M., Tindall, M. L., … Bonser, S.P. (2014). Which is a better predictor of plant traits: Temperature or precipitation? *Journal of Vegetation Science, 25*, 1167–1180.

Moles, A.T. (2018). Being John Harper: using evolutionary ideas to improve understanding of global patterns in plant traits. *Journal of Ecology, 106*(1), 1–18.

Muscarella, R., Lohbeck, M., Martínez-Ramos, M., Poorter, L., Rodríguez-Velázquez, J. E., van Breugel, M., & Bongers, F. (2017). Demographic drivers of functional composition dynamics. *Ecology, 98*, 2743-2750.

Nock, C.A., Vogt, R.J., & Beisner, B.E. (2016). Functional Traits. NJ, USA, eLS, Chichester.

Poggio, L., de Sousa, L. M., Batjes, N. H., Heuvelink, G. B. M., Kempen, B., Ribeiro, E., & Rossiter, D. (2021). SoilGrids 2.0: producing soil information for the globe with quantified spatial uncertainty. *Soil, 7*, 217–240.

Pinho, B.X., Tabarelli, M., ter Braak, C.J.F., Wright, S.J., Arroyo-Rodríguez, V., Benchimol, M., …Melo, F.P.L. (2021). Functional biogeography of Neotropical moist forests: Trait–climate relationships and assembly patterns of tree communities. *Global Ecology and Biogeography, 30*, 1430–1446.

Royal Botanic Gardens Kew (2020). Seed Information Database (SID). Version 7.1. Available from: http://data.kew.org/sid

Rubio de Casas, R., Willis, C. G., Pearse, W. D., Baskin, C. C., Baskin, J. M., & Cavender-Bares, J. (2017). Global biogeography of seed dormancy is determined by seasonality and seed size: A case study in the legumes. New *Phytologist, 214,* 1527–1536.

Saatkamp, A., Cochrane, A., Commander, L., Guja, L.K., Jimenez-Alfaro, B., Larson, J., … Walck, JL. (2019). A research agenda for seed-trait functional ecology. *New Phytologist*, *221*, 1764–1775.

Slessarev, E.W., Lin, Y., Bingham, N.L., Johnson, J.E., Dai, Y., Schimel, J.P., Chadwick, O.A., (2016). Water balance creates a threshold in soil pH at the global scale. *Nature,* 540, 567-569.

Stevenson, P, R. (2015). Neotropical primate communities: Effects of disturbance, resource production and forest type heterogeneity. *American Journal of Primatology*, *78*, 391-401.

Swenson, N. G., & Enquist, B. J. (2007). Ecological and evolutionary determinants of a key plant functional trait: Wood density and its community-wide variation across latitude and elevation. *American Journal of Botany*, *94*, 451–459.

Tabarelli, M., Vicente, A., & Barbosa, D. (2003). Variation of seed dispersal spectrum of woody plants across a rainfall gradient in North-Eastern Brazil. *Journal of Arid Environments, 53*, 197–210.

ter Steege, H., Pitman, N.C., Phillips, O.L., Chave, J., Sabatier, D., Duque, A., … Castellanos, H. (2006). Continental-scale patterns of canopy tree composition and function across Amazonia. *Nature, 443*, 444–447.

Turner, M. G., Calder W. John, Cumming, G. S., Hughes, T. P., Jentsch. A., …Carpenter, S. R. (2020). Climate change, ecosystems and abrupt change: science priorities. *Philosophical Transactions Royal Society B*. *375*(1794), 1–11.

van Buuren, S., & Groothuis-Oudshoorn, K. (2011). mice: Multivariate Imputation by Chained Equations in R. *Journal of Statistical Software, 45*, 1-67.

Van der Pijl, L. (1982). Principles of dispersal. Springer Verlag.

Walters, M. B., & Reich, P. B. (2000). Seed size, nitrogen supply, and growth rate affect tree seedling survival in deep shade. *Ecology, 81*, 1887–1901.

Weil, R.R., & Brady, N.C. (2017). Soil Architecture and Physical Properties. In R.R. Weil, & N.C. Brady (Eds.), *The Nature and Properties of Soils* (vol 4, pp.130–186). Pearson Press, Upper Saddle River NJ.

Westoby, M., Leishman, M., & Lord, J. (1996). Comparative ecology of seed size and dispersal. *Philosophical Transactions of the Royal Society of London B*, *351*, 1309–1318.

Westoby, M., Falster, D. S., Moles, A. T., Vesk, P. A., & Wright, I. J. (2002). Plant ecological strategies: Some leading dimensions of variation between species. *Annual Review of Ecology and Systematics*, *33*, 125–159.

Wilman, W., Belmaker, J., Simpson, J., de la Rosa, C., Rivadeneira, M.M. & Jetz, W. (2014). EltonTraits 1.0: Species-level foraging attributes of the world's birds and mammals. *Ecology, 95*, 2027

Supporting information

APPENDIX I

Table S1: Definitions of seed dispersal modes categories

Dispersal categories	Description
1) Endo stricto	endozoochorous; endozoochorous AND synzoochorous/ hydrochorous
2) Endo lato	endozoochorous OR (AND/OR) autochorous/synzoochorous /hydrochorous
3) Synzo stricto	synzoochorous; synzoochorous AND autochorous/barochorous/ hydrochorous
4) Synzo lato	synzoochorous OR autochorous/hydrochorous/barochorous AND/OR hydrochorous
5) Mymerco stricto	myrmecochorous; myrmecochorous and autochorous/barochorous
6) Mymerco lato	myrmecochorous AND/OR autochorous
7) Anemo stricto	anemochorous; anemochorous AND hydrochorous
8) Anemo lato	anemochorous OR autochorous/hydrochorous AND/OR hydrochorous
9) Auto stricto	autochorous
10) Auto lato	autochorous OR barochorous/hydrochorous AND/OR hydrochorous

Table S2: Descriptions of the climate and soil predictor variables used in this study.

Code	Description	Unit	Min-Max
Climate			
MAT	Annual Mean Temperature	º C	15.72-27.37
MeanDiuRan	Mean Temperature Diurnal Range (Mean of monthly (max temp - min temp))	º C	7.91-14.80
ISO	Isothermality (MeanDiuRan/TempAnnRan) *100	%	55.9-85.93
ST	Temperature Seasonality (standard deviation *100)	º C	28.95-260.51
MaxTempWarMon	Max Temperature of Warmest Month	º C	24.6-35.5
MinTempColMon	Min Temperature of Coldest Month	º C	4.19-22.29
TempAnnRan	Temperature Annual Range (MaxTempWarMon-MinTempColMon)	º C	9.80-21.29
MeanTempWettQuar	Mean Temperature of Wettest Quarter	º C	18.56-26.88
MeanTempDriQuar	Mean Temperature of Driest Quarter	º C	12.41-27.54
MeanTempWarQuar	Mean Temperature of Warmest Quarter	º C	18.56-27.96
MeanTempColQuar	Mean Temperature of Coldest Quarter	º C	12.41-26.68
MAP	Annual Precipitation	Mm	507-2569
PrecWettMon	Precipitation of Wettest Month	Mm	90-451
PrecDriMon	Precipitation of Driest Month	Mm	1-108
SP	Precipitation Seasonality (Coefficient of Variation)	Mm	39.21-109.89
PrecWettQuar	Precipitation of Wettest Quarter	Mm	219-1200
PrecDriQuar	Precipitation of Driest Quarter	Mm	3-335

PrecWarQuar	Precipitation of Warmest Quarter	Mm	48-988
PrecColQuar	Precipitation of Coldest Quarter	Mm	3-1200
Soil			
Chemical			
SOC	Soil organic carbon content in the fine earth fraction	g/kg	5.35-52.62
OCD	Organic carbon density	kg/m^3	10.43-26.35
OCS	Organic carbon stocks	kg/m^2	1.9-8.7
N	Total nitrogen	g/kg	6.90-28.12
CEC	Cation exchange capacity	cmol(c)/kg	5.48-21.16
PH	pH of water	pH	4.13-6.83
Physical			
BDOD	Bulk density of the fine earth fraction	kg/dm^3	1.08-1.44
CLAY	Proportion of clay particles (< 0.002 mm) in the fine earth fraction	g/100g (%)	21.25-68.13
CFVO	Volumetric fraction of coarse fragments (> 2 mm)	cm3/100cm3 (vol%)	0.98-18.61
SAND	Proportion of sand particles (> 0.05 mm) in the fine earth fraction	g/100g (%)	21.25-68.13
SILT	Proportion of silt particles (≥ 0.002 mm and ≤ 0.05 mm) in the fine earth fraction	g/100g (%)	9.46-53.53

Table S3: Models summary table show each predictor variable and their corresponding number, hyperparameters selected by tunning process with cross validation (ntree, mtry and nodesize), mean squared error (MSE) and variance explained (R^2).

Models	Predictors	N predictors	ntree	mtry	nodesize	MSE	R^2
ENDO LATO	SP,PH,TempAnnRan,PrecWarQuar, ISO,OCD,BDOD,pri_bIQR,SILT, ST	10	50	7	5	0.005	0.91
ENDO STRICTO	ST, PrecWettQuar, pH,CFVO,PrecDriQuar,ISO,pri_bIQR,BDOD,OCD,TempAnnRan	10	70	7	19	0.009	0.83
ANEMO LATO	PrecDriQuar,Wind speed, MeanDiuRan, MAT,ISO,PrecColQuar,pH,OCD, BDOD	9	110	6	5	0.004	0.92
ANEMO STRICTO	SP, Wind speed, ISO,MeanDiuRan,pH,PrecWarQuar,MAT,BDOD	8	70	3	5	0.004	0.90
SYNZO LATO	ST, ISO, MeanDiuRan, CFVO,pH,BDOD,PrecWarQuar,pri_bIQR,PrecDriQuar,PrecColQuar	10	70	3	13	0.003	0.83
SYNZO STRICTO	ST,PrecWettQuar,pH,CFVO,PrecDriQuar, ISO,pri_bIQR,BDOD,OCD,TempAnnRan	10	50	9	17	0.001	0.82
CWM seed mass	PrecDriQuar,Wind speed, ST, MeanDiuRan, MeanTempWettQuar,BDOD, pri_bIQR,ISO,pH,PrecWarQuar,CFVO	12	70	3	19	0.154	0.83

Table S4: Percentages of dispersal modes per specie/morphospecies and individuals within 301 old-growth plots across Brazilian biomes (Amazon, Atlantic Forest, Cerrado and Caatinga)

Dispersal mode	N Species	%	N Individuals	%
Endozoochory	1459	0.663	99714	0.579
Anemochory	330	0.150	39222	0.228
Autochory	109	0.050	14122	0.082
Synzoochory	195	0.089	14046	0.082
Myrmecochory	30	0.014	3638	0.021
NA	60	0.027	993	0.006
Hydrochory	18	0.008	402	0.002
Barochory	1	0.000	81	0.000
Total	2202	1.000	172218	1.000

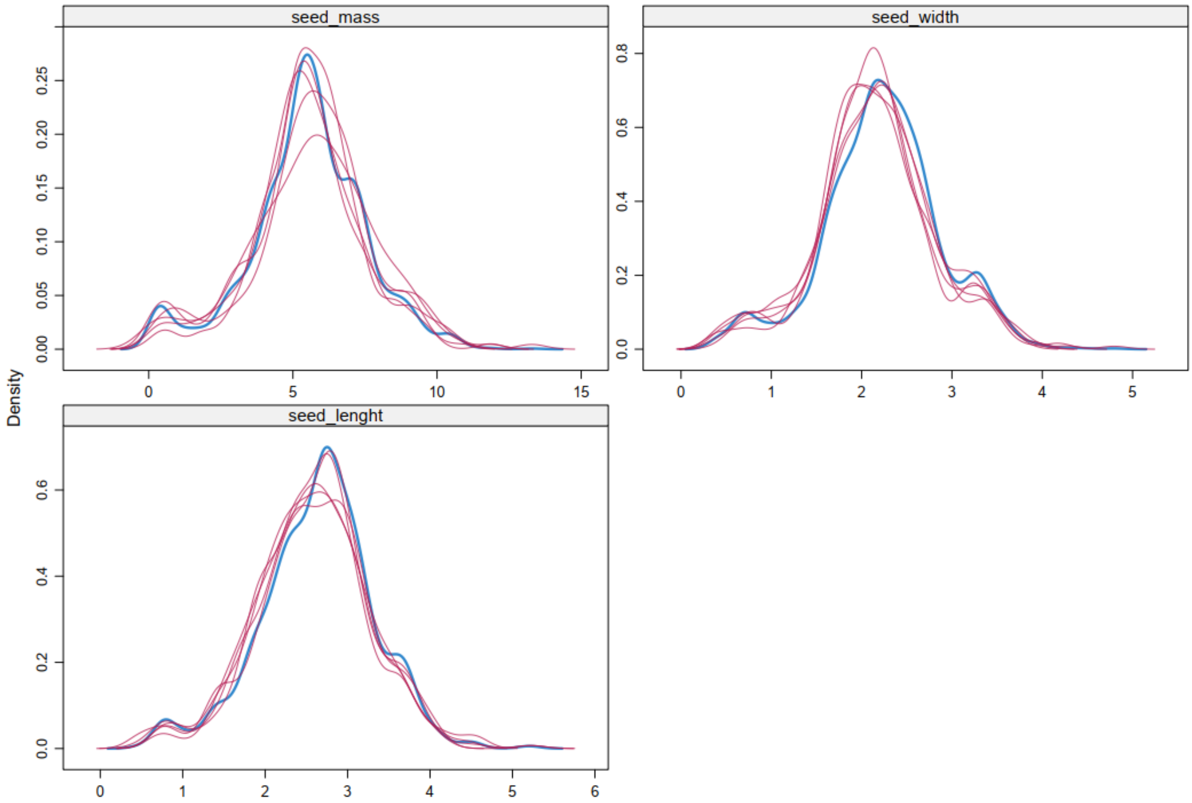

Figure S1: Plots show the density of seed size distribution at specie level for the original data (blue line) and five imputed datasets (red) on log scale. Trait imputation was performed through chained equations by predictive mean matching, using R package 'mice'.

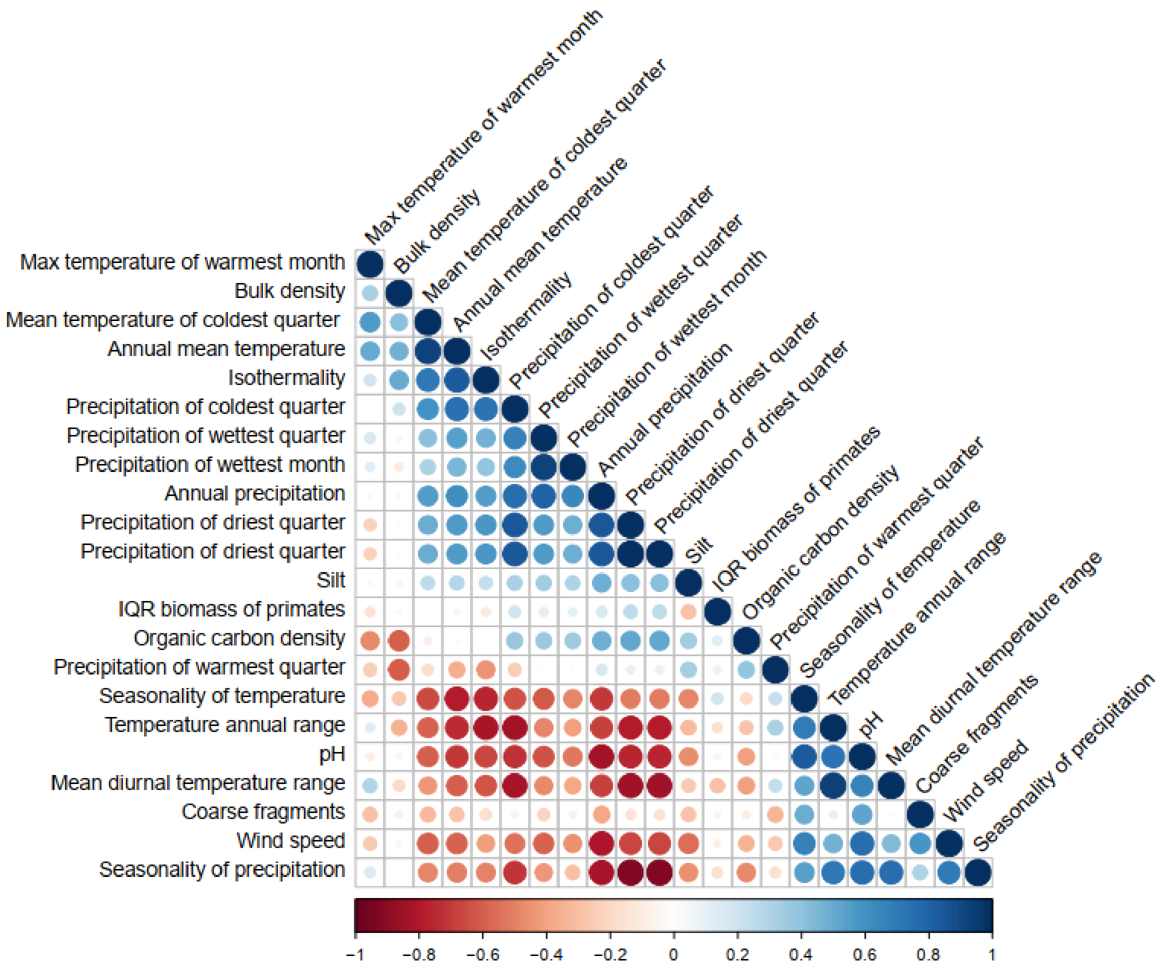

Figure S2: Explanatory variables using in random forest model to predict the proportional abundance of dispersal modes. The correlograms to the up illustrate the Spearman correlations between predictors using in the models by the colour and size of disk. Red colour indicate negative correlations and blue colour indicate negative correlations. Large disk size show strong correlations and small size disk show weak correlations.

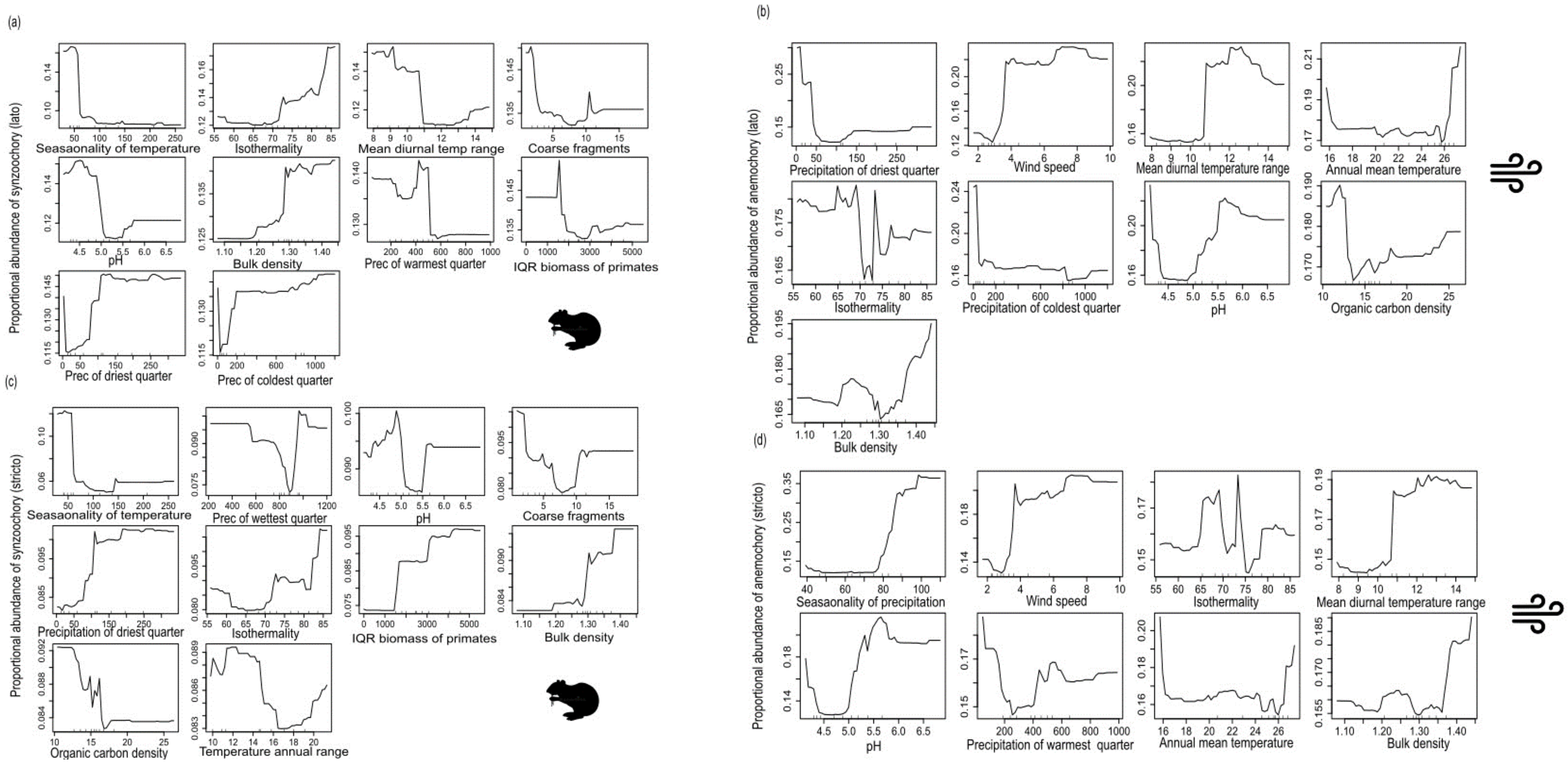

Figure S3: Partial dependence of the proportion of synzoochory and anemochory on each predictor variable. We draw a partial dependence showing the mean marginal influence on 12 explanatory variables on the proportional abundance of synzoochory an anemochory sensu lato (a,b) and stricto (b,d) while all the other predictors remained constant at their sample mean.

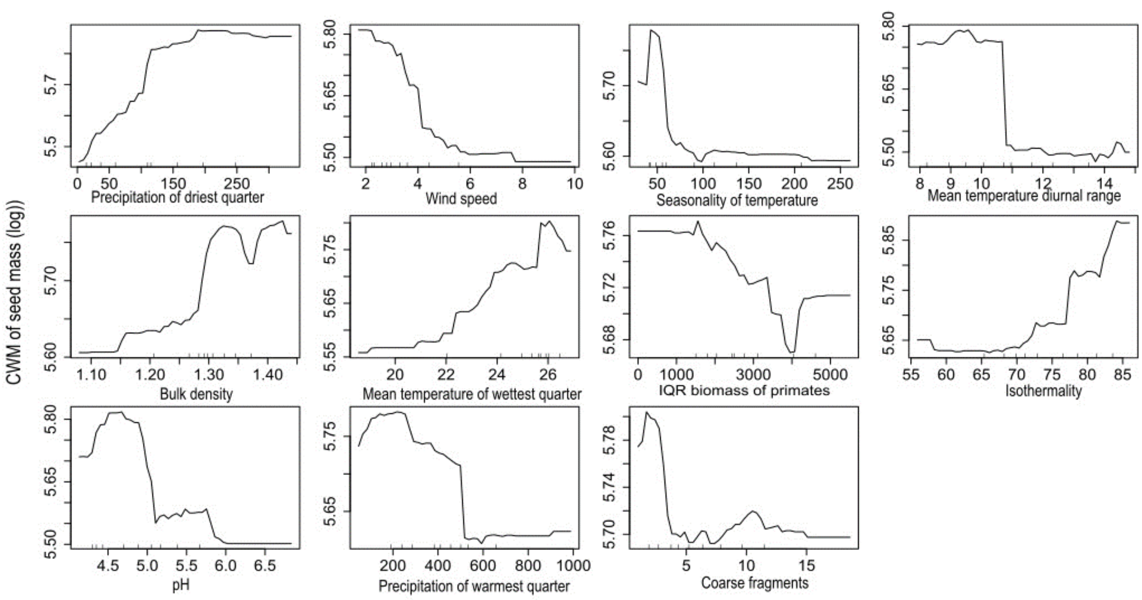

Figure S4: Partial dependence of the community weighted means (CWM) of seed mass on each predictor variable. We draw a partial dependence showing the mean marginal influence on 11 explanatory variables on CWM values (log scale) while all the other predictors remained constant at their sample mean.

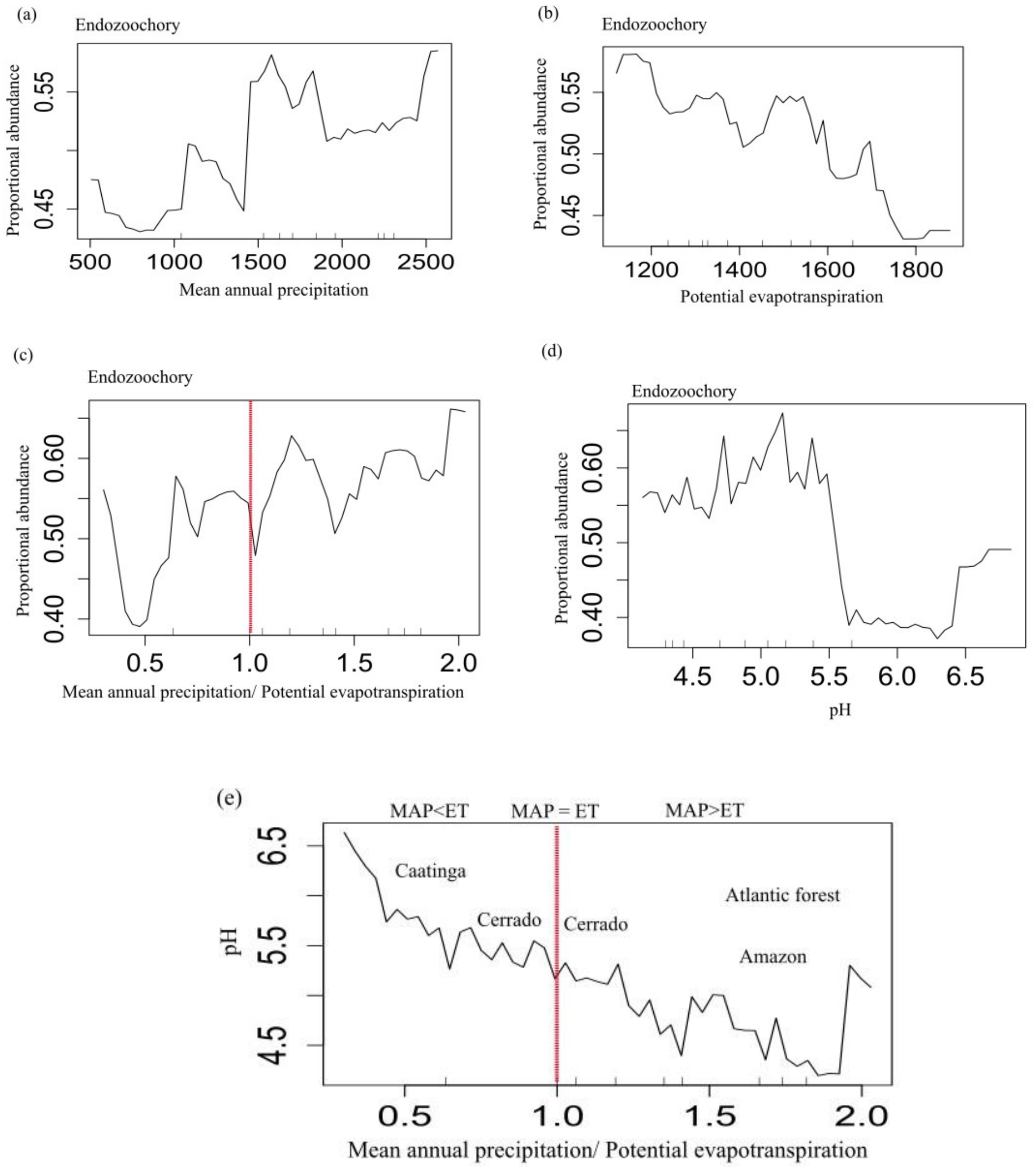

Figure S5: Graphs show relationships between the proportional abundance of endozoochory and gradients of (a) mean annual precipitation (MAP), (b) potential evapotranspiration (ET), (c) water balance (MAP/ET) and (d) soil pH. Values above 1 indicate that MAP exceed ET (positive water balance) while values less than 1 indicate that ET demand exceed MAP (negative water balance). (e) Gradients of water balance are related to soil pH levels across our cross-biome assessment.

APPENDIX II

Table 1: Dispersal modes and seed mass values assigned to 2,202 species and morphospecies within 301 old-growth plots across Brazilian biomes (Amazon, Atlantic Forest, Cerrado and Caatinga)

Plot	Bioma	CWM SM (mg)	Anemo lato (%)	Anemo stricto (%)	Auto lato (%)	Auto stricto (%)	Baro (%)	Endo lato (%)	Endo stricto (%)	Hydro (%)	Mymerco lato (%)	Mymerco stricto (%)	Synzo lato (%)	Synzo stricto (%)	NA (%)
CAX 01	Amazon	7.04	0.01	0.00	0.01	0.14	0.00	0.37	0.37	0.00	0.00	0.00	0.19	0.21	0.01
CAX 02	Amazon	6.76	0.05	0.00	0.00	0.06	0.00	0.51	0.51	0.00	0.00	0.00	0.15	0.17	0.01
CAX 06	Amazon	7.26	0.03	0.00	0.07	0.13	0.00	0.36	0.36	0.00	0.00	0.00	0.12	0.27	0.00
CNA 10	Amazon	4.11	0.47	0.00	0.00	0.00	0.00	0.37	0.37	0.00	0.00	0.00	0.00	0.16	0.00
CNA 11	Amazon	3.99	0.38	0.00	0.00	0.00	0.00	0.51	0.51	0.00	0.00	0.00	0.00	0.06	0.00
CNA 12	Amazon	6.14	0.09	0.00	0.00	0.00	0.00	0.32	0.32	0.00	0.00	0.00	0.04	0.11	0.00
CNA 13	Amazon	4.84	0.24	0.00	0.00	0.00	0.00	0.60	0.60	0.00	0.00	0.00	0.00	0.11	0.00
CNA 14	Amazon	7.32	0.03	0.00	0.00	0.00	0.00	0.53	0.53	0.00	0.00	0.00	0.07	0.28	0.00
CNA 20	Amazon	4.10	0.43	0.00	0.00	0.00	0.00	0.39	0.39	0.00	0.00	0.00	0.00	0.09	0.00
CNA 21	Amazon	4.44	0.44	0.00	0.00	0.00	0.00	0.28	0.28	0.00	0.00	0.00	0.00	0.12	0.00
CNA 22	Amazon	3.19	0.47	0.00	0.00	0.00	0.00	0.44	0.44	0.00	0.00	0.00	0.00	0.09	0.00
CNA 23	Amazon	5.36	0.17	0.00	0.00	0.00	0.00	0.55	0.55	0.00	0.00	0.00	0.11	0.17	0.00
CNA 24	Amazon	7.28	0.01	0.00	0.00	0.00	0.00	0.54	0.54	0.00	0.00	0.00	0.10	0.28	0.00
CNA 30	Amazon	6.41	0.09	0.00	0.00	0.00	0.00	0.30	0.30	0.01	0.00	0.00	0.12	0.10	0.00
CNA 31	Amazon	6.40	0.07	0.02	0.00	0.00	0.00	0.44	0.44	0.01	0.00	0.00	0.10	0.10	0.00
CNA 32	Amazon	4.98	0.16	0.00	0.00	0.00	0.00	0.48	0.48	0.00	0.00	0.00	0.00	0.15	0.00
CNA 33	Amazon	5.78	0.05	0.00	0.00	0.00	0.00	0.74	0.74	0.00	0.00	0.00	0.05	0.13	0.00
CNA 34	Amazon	5.81	0.07	0.00	0.00	0.00	0.00	0.63	0.63	0.00	0.00	0.00	0.09	0.13	0.00
CNA 40	Amazon	6.73	0.10	0.00	0.00	0.00	0.00	0.61	0.61	0.00	0.00	0.00	0.05	0.14	0.00

CNA 41	Amazon	6.50	0.13	0.00	0.00	0.00	0.00	0.33	0.33	0.00	0.00	0.00	0.06	0.11	0.00
CNA 42	Amazon	7.40	0.01	0.00	0.00	0.00	0.00	0.53	0.53	0.01	0.00	0.00	0.12	0.28	0.00
CNA 43	Amazon	5.92	0.07	0.00	0.00	0.00	0.00	0.60	0.60	0.00	0.00	0.00	0.13	0.18	0.00
CNA 44	Amazon	6.79	0.02	0.00	0.00	0.00	0.00	0.51	0.51	0.02	0.00	0.00	0.12	0.29	0.00
CNA 50	Amazon	6.47	0.11	0.00	0.00	0.00	0.00	0.41	0.41	0.00	0.00	0.00	0.14	0.18	0.00
CNA 51	Amazon	6.66	0.05	0.00	0.00	0.00	0.00	0.60	0.60	0.00	0.00	0.00	0.10	0.20	0.00
CNA 52	Amazon	6.53	0.07	0.00	0.00	0.00	0.00	0.66	0.66	0.01	0.00	0.00	0.06	0.10	0.00
CNA 53	Amazon	6.77	0.00	0.00	0.01	0.00	0.00	0.60	0.60	0.00	0.00	0.00	0.08	0.20	0.00
CNA 54	Amazon	6.96	0.02	0.00	0.00	0.00	0.00	0.56	0.56	0.03	0.00	0.00	0.11	0.20	0.00
CNA 60	Amazon	5.83	0.11	0.00	0.00	0.00	0.00	0.27	0.27	0.00	0.00	0.00	0.00	0.17	0.00
CNA 61	Amazon	6.44	0.11	0.00	0.00	0.00	0.00	0.55	0.55	0.00	0.00	0.00	0.05	0.17	0.00
CNA 62	Amazon	5.95	0.15	0.00	0.00	0.00	0.00	0.26	0.26	0.02	0.00	0.00	0.13	0.16	0.00
CNA 63	Amazon	6.41	0.10	0.00	0.00	0.00	0.00	0.69	0.69	0.00	0.00	0.00	0.08	0.09	0.00
CNA 64	Amazon	6.27	0.11	0.02	0.00	0.00	0.00	0.50	0.50	0.00	0.00	0.00	0.13	0.23	0.00
DUK 22	Amazon	6.56	0.03	0.01	0.00	0.05	0.00	0.55	0.55	0.00	0.00	0.00	0.11	0.12	0.00
DUK 32	Amazon	5.94	0.03	0.00	0.00	0.02	0.00	0.72	0.72	0.00	0.00	0.00	0.03	0.12	0.01
DUK 33	Amazon	6.29	0.01	0.00	0.00	0.07	0.00	0.57	0.57	0.00	0.00	0.00	0.13	0.11	0.02
DUK 34	Amazon	6.48	0.04	0.00	0.00	0.02	0.00	0.69	0.69	0.05	0.00	0.01	0.07	0.04	0.03
DUK 35	Amazon	6.23	0.03	0.00	0.00	0.03	0.00	0.61	0.61	0.00	0.00	0.00	0.12	0.11	0.00
DUK 41	Amazon	6.53	0.04	0.01	0.00	0.03	0.00	0.34	0.34	0.01	0.00	0.00	0.19	0.20	0.04
DUK 43	Amazon	6.37	0.04	0.01	0.00	0.04	0.00	0.52	0.52	0.00	0.00	0.01	0.14	0.08	0.00
DUK 44	Amazon	6.19	0.04	0.00	0.00	0.04	0.00	0.61	0.61	0.00	0.00	0.00	0.11	0.06	0.00
DUK 45	Amazon	6.00	0.04	0.01	0.00	0.04	0.00	0.59	0.59	0.01	0.00	0.00	0.11	0.07	0.01
DUK 61	Amazon	6.26	0.02	0.01	0.00	0.06	0.00	0.46	0.46	0.00	0.00	0.00	0.12	0.10	0.06
DUK 62	Amazon	6.35	0.01	0.00	0.00	0.05	0.00	0.53	0.53	0.01	0.00	0.00	0.07	0.13	0.02
DUK 63	Amazon	6.48	0.02	0.00	0.00	0.02	0.00	0.57	0.57	0.01	0.00	0.00	0.05	0.09	0.05
DUK 71	Amazon	6.51	0.00	0.00	0.00	0.02	0.00	0.66	0.66	0.01	0.00	0.00	0.14	0.10	0.01
DUK 72	Amazon	6.30	0.02	0.00	0.00	0.04	0.00	0.52	0.52	0.00	0.00	0.00	0.12	0.08	0.01
DUK 74	Amazon	6.50	0.02	0.00	0.00	0.05	0.00	0.60	0.60	0.00	0.00	0.00	0.14	0.08	0.01
DUK 81	Amazon	6.64	0.03	0.00	0.00	0.02	0.00	0.63	0.63	0.01	0.00	0.00	0.09	0.11	0.03
DUK 82	Amazon	6.07	0.01	0.00	0.00	0.03	0.00	0.59	0.59	0.01	0.00	0.00	0.10	0.08	0.08

TEC 01	Amazon	7.49	0.00	0.00	0.00	0.03	0.00	0.27	0.27	0.00	0.00	0.00	0.20	0.45	0.01
TEC 02	Amazon	7.15	0.01	0.00	0.06	0.12	0.00	0.32	0.32	0.04	0.00	0.00	0.13	0.27	0.03
TEC 03	Amazon	7.34	0.02	0.00	0.06	0.13	0.00	0.21	0.21	0.04	0.00	0.00	0.09	0.41	0.01
TEC 04	Amazon	6.97	0.04	0.00	0.00	0.11	0.00	0.38	0.38	0.00	0.00	0.00	0.12	0.30	0.03
TEC 05	Amazon	6.18	0.04	0.00	0.00	0.07	0.00	0.63	0.63	0.00	0.00	0.00	0.11	0.05	0.01
TEC 06	Amazon	6.87	0.05	0.00	0.00	0.02	0.00	0.46	0.46	0.00	0.00	0.00	0.20	0.22	0.00
TEM 01	Amazon	6.52	0.03	0.00	0.00	0.03	0.00	0.60	0.60	0.01	0.00	0.00	0.17	0.10	0.00
TEM 02	Amazon	6.48	0.02	0.01	0.00	0.03	0.00	0.65	0.65	0.01	0.00	0.00	0.13	0.08	0.00
TEM 03	Amazon	6.68	0.02	0.00	0.00	0.02	0.00	0.55	0.55	0.01	0.00	0.01	0.21	0.11	0.00
TEM 04	Amazon	6.02	0.05	0.00	0.00	0.16	0.00	0.52	0.52	0.02	0.00	0.01	0.14	0.04	0.00
TEM 05	Amazon	6.38	0.05	0.00	0.00	0.07	0.00	0.47	0.47	0.01	0.00	0.00	0.18	0.11	0.03
TEM 06	Amazon	6.41	0.02	0.00	0.00	0.04	0.00	0.70	0.70	0.00	0.00	0.00	0.09	0.08	0.01
IPM 20	Amazon	7.04	0.02	0.00	0.00	0.01	0.00	0.63	0.63	0.00	0.00	0.00	0.06	0.19	0.01
IPM 21	Amazon	6.26	0.02	0.00	0.00	0.02	0.00	0.59	0.59	0.00	0.00	0.00	0.12	0.13	0.01
IPM 22	Amazon	7.17	0.03	0.00	0.00	0.01	0.00	0.60	0.60	0.01	0.00	0.01	0.10	0.20	0.02
IPM 25	Amazon	6.90	0.03	0.00	0.00	0.00	0.00	0.67	0.67	0.00	0.00	0.00	0.12	0.14	0.00
IPM 26	Amazon	6.41	0.04	0.00	0.00	0.04	0.00	0.51	0.51	0.01	0.00	0.00	0.12	0.12	0.04
IPM 27	Amazon	6.72	0.07	0.00	0.00	0.02	0.00	0.47	0.47	0.00	0.00	0.00	0.14	0.05	0.05
IPM 28	Amazon	7.00	0.00	0.00	0.00	0.05	0.00	0.40	0.40	0.00	0.00	0.00	0.14	0.19	0.00
IPM 37	Amazon	7.08	0.04	0.00	0.00	0.00	0.00	0.47	0.47	0.01	0.00	0.00	0.10	0.20	0.00
IPM 39	Amazon	6.72	0.01	0.00	0.00	0.03	0.00	0.49	0.49	0.01	0.00	0.00	0.19	0.10	0.03
IPM 40	Amazon	6.74	0.05	0.00	0.00	0.01	0.00	0.15	0.15	0.07	0.00	0.00	0.26	0.28	0.01
IPM 42	Amazon	6.39	0.27	0.00	0.00	0.01	0.00	0.51	0.51	0.00	0.00	0.00	0.01	0.16	0.01
IPM 43	Amazon	6.73	0.10	0.00	0.00	0.01	0.00	0.60	0.60	0.01	0.00	0.00	0.07	0.15	0.02
IPM 46	Amazon	6.70	0.08	0.00	0.00	0.01	0.00	0.49	0.49	0.00	0.00	0.00	0.04	0.18	0.01
IPM 55	Amazon	6.78	0.01	0.00	0.00	0.04	0.00	0.46	0.46	0.00	0.00	0.00	0.17	0.14	0.03
IPM 62	Amazon	6.58	0.07	0.00	0.00	0.02	0.00	0.40	0.40	0.01	0.00	0.00	0.26	0.06	0.05
IPM 63	Amazon	6.56	0.05	0.01	0.00	0.03	0.00	0.48	0.48	0.00	0.00	0.00	0.19	0.10	0.06
IPM 64	Amazon	6.77	0.05	0.00	0.00	0.02	0.00	0.49	0.49	0.00	0.00	0.00	0.14	0.08	0.01
IPM 79	Amazon	6.83	0.03	0.00	0.00	0.03	0.00	0.48	0.48	0.01	0.00	0.00	0.16	0.11	0.03
IPM 80	Amazon	6.76	0.06	0.00	0.00	0.02	0.00	0.47	0.47	0.01	0.00	0.00	0.16	0.09	0.03

IPM 86	Amazon	6.58	0.02	0.00	0.00	0.07	0.00	0.53	0.53	0.00	0.00	0.00	0.12	0.09	0.01
IPM 87	Amazon	6.61	0.29	0.02	0.00	0.00	0.00	0.53	0.53	0.00	0.00	0.00	0.01	0.11	0.00
IPM 88	Amazon	7.03	0.04	0.00	0.00	0.00	0.00	0.65	0.65	0.00	0.00	0.00	0.19	0.08	0.00
IPM 98	Amazon	7.00	0.05	0.01	0.00	0.01	0.00	0.44	0.44	0.00	0.00	0.00	0.13	0.15	0.03
IPM 99	Amazon	6.88	0.05	0.00	0.00	0.02	0.00	0.51	0.51	0.01	0.00	0.00	0.08	0.13	0.03
PSM 01	Amazon	7.49	0.00	0.00	0.00	0.00	0.00	0.81	0.81	0.00	0.00	0.00	0.00	0.19	0.00
RBR 01	Amazon	6.94	0.03	0.00	0.00	0.04	0.00	0.46	0.46	0.00	0.00	0.00	0.16	0.13	0.04
VIR 11	Amazon	6.70	0.06	0.00	0.00	0.00	0.00	0.65	0.65	0.02	0.00	0.00	0.00	0.27	0.00
VIR 12	Amazon	5.77	0.00	0.00	0.00	0.00	0.00	0.80	0.80	0.00	0.00	0.00	0.00	0.20	0.00
VIR 14	Amazon	6.08	0.09	0.02	0.00	0.00	0.00	0.58	0.58	0.00	0.00	0.00	0.00	0.31	0.00
VIR 21	Amazon	5.69	0.06	0.00	0.00	0.00	0.00	0.84	0.84	0.00	0.00	0.00	0.00	0.07	0.02
VIR 22	Amazon	6.51	0.07	0.00	0.00	0.00	0.00	0.65	0.65	0.00	0.00	0.00	0.00	0.27	0.00
VIR 23	Amazon	5.72	0.02	0.00	0.00	0.00	0.00	0.73	0.73	0.00	0.00	0.00	0.00	0.25	0.00
VIR 32	Amazon	5.90	0.07	0.00	0.00	0.00	0.00	0.69	0.69	0.00	0.00	0.00	0.00	0.21	0.00
VIR 33	Amazon	6.34	0.00	0.00	0.00	0.00	0.00	0.73	0.73	0.00	0.00	0.00	0.00	0.27	0.00
VIR 34	Amazon	6.11	0.19	0.00	0.00	0.00	0.00	0.46	0.46	0.00	0.00	0.00	0.00	0.35	0.00
VIR 42	Amazon	5.28	0.02	0.00	0.00	0.00	0.00	0.73	0.73	0.19	0.00	0.00	0.00	0.06	0.00
VIR 43	Amazon	5.77	0.09	0.00	0.00	0.00	0.00	0.76	0.76	0.06	0.00	0.00	0.00	0.08	0.00
VIR 61	Amazon	5.41	0.13	0.00	0.00	0.00	0.00	0.64	0.64	0.02	0.00	0.00	0.00	0.20	0.00
ALE 01	Amazon	5.67	0.15	0.00	0.00	0.11	0.00	0.50	0.50	0.00	0.00	0.00	0.10	0.12	0.00
CAJ 01	Amazon	5.42	0.06	0.00	0.00	0.28	0.00	0.56	0.56	0.00	0.00	0.00	0.00	0.06	0.00
CAJ 02	Amazon	5.17	0.09	0.01	0.00	0.14	0.00	0.66	0.66	0.00	0.00	0.00	0.00	0.03	0.00
CAJ 03	Amazon	5.69	0.06	0.00	0.00	0.11	0.00	0.72	0.72	0.00	0.00	0.00	0.02	0.05	0.01
DNA 01	Amazon	6.01	0.01	0.00	0.00	0.25	0.00	0.61	0.61	0.00	0.00	0.00	0.02	0.03	0.01
DUK 53	Amazon	6.46	0.03	0.00	0.00	0.02	0.00	0.61	0.61	0.00	0.00	0.00	0.12	0.12	0.01
DUK 54	Amazon	6.16	0.05	0.00	0.00	0.05	0.00	0.57	0.57	0.01	0.00	0.00	0.10	0.06	0.00
DUK 56	Amazon	6.25	0.01	0.00	0.00	0.02	0.00	0.66	0.66	0.01	0.00	0.00	0.11	0.08	0.01
FRE 01	Amazon	5.92	0.15	0.00	0.00	0.00	0.00	0.55	0.55	0.00	0.00	0.00	0.08	0.19	0.00
UAT 72	Amazon	6.60	0.01	0.00	0.00	0.23	0.00	0.51	0.51	0.00	0.00	0.00	0.09	0.15	0.01
VAV 01	Amazon	5.31	0.11	0.00	0.00	0.03	0.00	0.73	0.73	0.00	0.00	0.00	0.06	0.07	0.00
ABU 12	Amazon	6.30	0.01	0.02	0.00	0.06	0.00	0.41	0.41	0.00	0.00	0.00	0.07	0.22	0.03

ABU 14	Amazon	6.26	0.03	0.01	0.00	0.07	0.00	0.46	0.46	0.00	0.00	0.00	0.07	0.22	0.01
ABU 15	Amazon	5.79	0.10	0.00	0.00	0.10	0.00	0.55	0.55	0.02	0.00	0.00	0.09	0.07	0.04
ALF 01	Amazon	5.44	0.04	0.01	0.00	0.02	0.00	0.84	0.84	0.00	0.00	0.00	0.00	0.00	0.00
ALF 02	Amazon	6.11	0.01	0.00	0.00	0.01	0.00	0.69	0.69	0.00	0.00	0.00	0.01	0.01	0.01
COT 02	Amazon	5.62	0.07	0.00	0.00	0.00	0.00	0.72	0.72	0.00	0.00	0.00	0.02	0.00	0.00
COT 03	Amazon	5.41	0.05	0.02	0.00	0.04	0.00	0.70	0.70	0.00	0.00	0.00	0.03	0.00	0.00
COT 04	Amazon	5.05	0.07	0.00	0.00	0.00	0.00	0.87	0.87	0.00	0.00	0.00	0.02	0.02	0.00
COT 05	Amazon	5.47	0.08	0.00	0.00	0.00	0.00	0.86	0.86	0.00	0.00	0.00	0.02	0.00	0.00
COT 06	Amazon	6.15	0.00	0.00	0.00	0.00	0.00	0.67	0.67	0.00	0.00	0.00	0.09	0.02	0.00
DOI 01	Amazon	5.73	0.11	0.02	0.00	0.04	0.00	0.63	0.63	0.00	0.00	0.00	0.05	0.06	0.01
DOI 02	Amazon	5.00	0.21	0.02	0.00	0.08	0.00	0.52	0.52	0.00	0.00	0.00	0.01	0.04	0.03
FEC 01	Amazon	6.10	0.13	0.03	0.01	0.08	0.00	0.52	0.52	0.00	0.00	0.00	0.04	0.12	0.01
MIN 01	Amazon	6.27	0.10	0.01	0.00	0.00	0.00	0.65	0.65	0.00	0.00	0.04	0.03	0.07	0.03
MTH 01	Amazon	6.32	0.03	0.03	0.00	0.07	0.00	0.42	0.42	0.00	0.00	0.08	0.01	0.16	0.09
PEC 01	Amazon	5.52	0.04	0.08	0.00	0.12	0.00	0.63	0.63	0.00	0.00	0.01	0.03	0.06	0.00
PEC 02	Amazon	5.73	0.04	0.05	0.00	0.09	0.00	0.68	0.68	0.00	0.00	0.00	0.00	0.10	0.00
PEC 03	Amazon	6.20	0.03	0.03	0.00	0.04	0.00	0.60	0.60	0.00	0.00	0.00	0.00	0.04	0.00
PEC 04	Amazon	5.54	0.08	0.05	0.00	0.07	0.00	0.71	0.71	0.00	0.00	0.00	0.01	0.04	0.01
PEC 05	Amazon	5.21	0.08	0.05	0.00	0.07	0.00	0.63	0.63	0.00	0.00	0.01	0.02	0.08	0.00
PGR 01	Amazon	6.60	0.04	0.00	0.00	0.16	0.01	0.33	0.33	0.00	0.00	0.06	0.16	0.20	0.00
PGR 02	Amazon	6.58	0.03	0.00	0.00	0.13	0.07	0.33	0.33	0.01	0.00	0.10	0.07	0.17	0.00
PGR 03	Amazon	6.86	0.02	0.02	0.00	0.06	0.02	0.37	0.37	0.00	0.00	0.04	0.24	0.14	0.00
PGR 05	Amazon	6.49	0.04	0.00	0.00	0.04	0.02	0.44	0.44	0.00	0.00	0.03	0.13	0.20	0.00
PGR 06	Amazon	6.88	0.01	0.01	0.00	0.18	0.05	0.33	0.33	0.00	0.00	0.01	0.15	0.18	0.00
PGR 07	Amazon	6.75	0.06	0.00	0.00	0.14	0.01	0.24	0.24	0.11	0.00	0.08	0.17	0.13	0.00
PGR 08	Amazon	6.02	0.01	0.06	0.00	0.09	0.00	0.35	0.35	0.02	0.00	0.07	0.11	0.12	0.00
PGR 10	Amazon	6.79	0.03	0.00	0.00	0.20	0.03	0.33	0.33	0.01	0.00	0.03	0.19	0.12	0.00
PGR 12	Amazon	6.68	0.02	0.00	0.00	0.13	0.04	0.36	0.36	0.00	0.00	0.02	0.11	0.20	0.00
PGS 01	Amazon	6.70	0.01	0.00	0.00	0.06	0.01	0.37	0.37	0.02	0.00	0.00	0.18	0.19	0.00
PGS 02	Amazon	6.34	0.02	0.01	0.00	0.14	0.01	0.36	0.36	0.00	0.00	0.02	0.11	0.19	0.01
PGS 03	Amazon	6.69	0.00	0.01	0.00	0.06	0.04	0.30	0.30	0.01	0.00	0.02	0.15	0.27	0.00

PGS 04	Amazon	6.78	0.02	0.00	0.00	0.14	0.04	0.30	0.30	0.00	0.00	0.04	0.20	0.24	0.00
POR 01	Amazon	5.45	0.00	0.00	0.00	0.00	0.00	0.79	0.79	0.00	0.00	0.01	0.05	0.03	0.00
POR 02	Amazon	5.84	0.05	0.00	0.00	0.04	0.00	0.74	0.74	0.00	0.00	0.01	0.05	0.04	0.00
RFH 01	Amazon	5.66	0.15	0.02	0.00	0.02	0.00	0.57	0.57	0.00	0.00	0.00	0.02	0.10	0.03
RFH 03	Amazon	5.97	0.01	0.00	0.00	0.25	0.00	0.51	0.51	0.00	0.00	0.00	0.03	0.05	0.03
RST 01	Amazon	6.72	0.04	0.01	0.00	0.00	0.00	0.54	0.54	0.00	0.00	0.00	0.01	0.16	0.05
STL 08	Amazon	5.92	0.06	0.00	0.03	0.08	0.00	0.57	0.57	0.00	0.00	0.00	0.07	0.04	0.00
STL 11	Amazon	6.41	0.04	0.00	0.10	0.23	0.00	0.32	0.32	0.00	0.00	0.05	0.08	0.09	0.00
STO 03	Amazon	6.46	0.01	0.00	0.00	0.06	0.00	0.61	0.61	0.00	0.00	0.04	0.08	0.10	0.02
STO 04	Amazon	6.29	0.06	0.00	0.00	0.13	0.00	0.53	0.53	0.00	0.00	0.00	0.09	0.16	0.00
STO 05	Amazon	6.02	0.21	0.01	0.00	0.03	0.00	0.59	0.59	0.00	0.00	0.00	0.03	0.05	0.00
STO 06	Amazon	5.33	0.05	0.01	0.00	0.07	0.00	0.54	0.54	0.00	0.00	0.00	0.09	0.19	0.01
STO 07	Amazon	6.10	0.02	0.00	0.00	0.11	0.00	0.61	0.61	0.00	0.00	0.00	0.11	0.09	0.02
STO 08	Amazon	6.32	0.06	0.01	0.00	0.07	0.00	0.62	0.62	0.00	0.00	0.00	0.06	0.11	0.00
STP 03	Amazon	6.53	0.01	0.00	0.00	0.00	0.00	0.69	0.69	0.00	0.00	0.00	0.03	0.20	0.02
STP 09	Amazon	5.98	0.04	0.00	0.00	0.33	0.00	0.37	0.37	0.00	0.00	0.02	0.01	0.06	0.02
STT 01	Amazon	5.69	0.13	0.00	0.00	0.06	0.00	0.72	0.72	0.00	0.00	0.00	0.00	0.07	0.01
STT 02	Amazon	6.17	0.05	0.00	0.00	0.05	0.00	0.68	0.68	0.00	0.00	0.00	0.01	0.13	0.01
STT 04	Amazon	5.82	0.15	0.00	0.00	0.27	0.00	0.47	0.47	0.00	0.00	0.00	0.04	0.04	0.00
STT 05	Amazon	5.44	0.11	0.00	0.00	0.18	0.00	0.62	0.62	0.00	0.00	0.00	0.04	0.03	0.00
TGS 01	Amazon	5.88	0.02	0.00	0.00	0.38	0.00	0.51	0.51	0.00	0.00	0.00	0.00	0.02	0.06
FLO 02	Amazon	4.40	0.13	0.00	0.00	0.00	0.00	0.82	0.82	0.00	0.00	0.00	0.00	0.03	0.00
FRP 01	Amazon	5.81	0.07	0.00	0.00	0.00	0.00	0.67	0.67	0.00	0.00	0.00	0.00	0.14	0.03
FRP 02	Amazon	4.27	0.74	0.00	0.00	0.00	0.00	0.26	0.26	0.00	0.00	0.00	0.00	0.00	0.00
GAU 02	Amazon	6.82	0.00	0.00	0.00	0.00	0.00	0.95	0.95	0.00	0.00	0.00	0.00	0.00	0.00
GAU 04	Amazon	4.09	0.06	0.00	0.00	0.00	0.00	0.86	0.86	0.00	0.00	0.00	0.00	0.08	0.00
GAU 05	Amazon	4.36	0.00	0.00	0.00	0.00	0.00	0.86	0.86	0.00	0.00	0.00	0.00	0.00	0.00
GAU 06	Amazon	6.15	0.03	0.00	0.00	0.00	0.00	0.77	0.77	0.00	0.00	0.00	0.00	0.04	0.00
GAU 07	Amazon	5.13	0.05	0.00	0.00	0.00	0.00	0.84	0.84	0.00	0.00	0.00	0.00	0.00	0.00
GUP 01	Amazon	5.49	0.17	0.00	0.00	0.00	0.00	0.83	0.83	0.00	0.00	0.00	0.00	0.00	0.00
GUP 02	Amazon	5.02	0.18	0.00	0.00	0.00	0.00	0.82	0.82	0.00	0.00	0.00	0.00	0.00	0.00

GUP 03	Amazon	4.70	0.14	0.00	0.00	0.00	0.00	0.86	0.86	0.00	0.00	0.00	0.00	0.00	0.00
GUP 06	Amazon	5.59	0.02	0.00	0.00	0.00	0.00	0.93	0.93	0.00	0.00	0.00	0.00	0.05	0.00
GUP 07	Amazon	4.12	0.19	0.00	0.00	0.00	0.00	0.81	0.81	0.00	0.00	0.00	0.00	0.00	0.00
GUP 08	Amazon	5.66	0.13	0.00	0.00	0.00	0.00	0.83	0.83	0.00	0.00	0.00	0.00	0.04	0.00
GUP 09	Amazon	4.38	0.11	0.00	0.00	0.00	0.00	0.83	0.83	0.00	0.00	0.00	0.00	0.00	0.00
GUP 10	Amazon	4.51	0.30	0.00	0.00	0.00	0.00	0.63	0.63	0.00	0.00	0.00	0.00	0.08	0.00
GUP 11	Amazon	6.29	0.23	0.19	0.00	0.29	0.00	0.16	0.16	0.00	0.00	0.00	0.00	0.06	0.00
NXV 01	Amazon	4.95	0.55	0.00	0.01	0.00	0.00	0.28	0.28	0.00	0.00	0.00	0.02	0.01	0.00
NXV 03	Amazon	5.09	0.46	0.00	0.01	0.00	0.00	0.43	0.43	0.00	0.00	0.00	0.01	0.00	0.00
NXV 05	Amazon	4.59	0.42	0.00	0.02	0.00	0.00	0.48	0.48	0.00	0.00	0.01	0.00	0.00	0.00
NXV 06	Amazon	6.32	0.17	0.00	0.00	0.00	0.00	0.41	0.41	0.00	0.00	0.00	0.00	0.39	0.00
NXV 07	Amazon	5.33	0.36	0.00	0.00	0.00	0.00	0.52	0.52	0.00	0.00	0.00	0.00	0.12	0.00
NXV 09	Amazon	5.03	0.25	0.00	0.00	0.00	0.00	0.65	0.65	0.00	0.00	0.00	0.02	0.05	0.00
POA 01	Amazon	4.95	0.03	0.00	0.00	0.00	0.00	0.82	0.82	0.00	0.00	0.00	0.02	0.01	0.04
RON 01	Amazon	5.38	0.10	0.00	0.00	0.00	0.00	0.83	0.83	0.00	0.00	0.00	0.00	0.07	0.00
RON 02	Amazon	5.40	0.13	0.00	0.00	0.00	0.00	0.78	0.78	0.00	0.00	0.00	0.00	0.09	0.00
SAA 01	Amazon	5.75	0.03	0.00	0.00	0.00	0.00	0.86	0.86	0.00	0.00	0.00	0.02	0.08	0.00
SAA 02	Amazon	6.39	0.04	0.00	0.00	0.00	0.00	0.69	0.69	0.00	0.00	0.00	0.00	0.25	0.00
SAT 02	Amazon	5.26	0.45	0.03	0.00	0.00	0.00	0.46	0.46	0.00	0.00	0.00	0.00	0.05	0.00
SIP 01	Amazon	5.59	0.07	0.00	0.00	0.00	0.00	0.90	0.90	0.00	0.00	0.00	0.00	0.03	0.00
SMT 01	Amazon	5.91	0.22	0.06	0.00	0.00	0.00	0.69	0.69	0.00	0.00	0.00	0.00	0.03	0.00
SMT 02	Amazon	6.09	0.42	0.00	0.00	0.00	0.00	0.56	0.56	0.00	0.00	0.00	0.00	0.00	0.00
SMT 03	Amazon	5.84	0.40	0.03	0.00	0.00	0.00	0.57	0.57	0.00	0.00	0.00	0.00	0.00	0.00
SOR 01	Amazon	5.31	0.59	0.00	0.00	0.00	0.00	0.29	0.29	0.00	0.00	0.00	0.00	0.12	0.00
TAN 02	Amazon	4.45	0.10	0.00	0.00	0.00	0.00	0.85	0.85	0.00	0.00	0.00	0.00	0.02	0.00
TAN 03	Amazon	4.57	0.09	0.00	0.00	0.00	0.00	0.88	0.88	0.00	0.00	0.00	0.00	0.00	0.00
TAN 04	Amazon	4.17	0.05	0.00	0.00	0.00	0.00	0.91	0.91	0.00	0.00	0.00	0.00	0.00	0.00
FLO 01	Amazon	4.79	0.11	0.00	0.00	0.00	0.00	0.79	0.79	0.00	0.00	0.00	0.00	0.07	0.00
NXV 02	Amazon	4.90	0.25	0.00	0.00	0.00	0.00	0.55	0.55	0.00	0.00	0.00	0.00	0.08	0.00
VCR 03	Amazon	6.80	0.00	0.00	0.00	0.00	0.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
VCR 04	Amazon	5.32	0.00	0.00	0.00	0.00	0.00	0.68	0.68	0.00	0.00	0.00	0.00	0.19	0.00

VCR 01	Amazon	6.21	0.00	0.00	0.00	0.00	0.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
VCR 02	Amazon	5.49	0.00	0.00	0.00	0.00	0.00	0.74	0.74	0.00	0.00	0.00	0.00	0.19	0.00
CLI 01	Atlantic forest	5.24	0.25	0.02	0.00	0.05	0.00	0.64	0.64	0.00	0.00	0.01	0.00	0.00	0.00
COQ 01	Atlantic forest	4.55	0.13	0.01	0.00	0.09	0.00	0.70	0.70	0.00	0.00	0.05	0.00	0.00	0.00
COQ 02	Atlantic forest	5.06	0.03	0.01	0.00	0.25	0.00	0.61	0.61	0.00	0.00	0.09	0.00	0.01	0.00
CRR 01	Atlantic forest	4.08	0.14	0.00	0.00	0.00	0.00	0.80	0.80	0.00	0.00	0.00	0.00	0.00	0.00
IBI 01	Atlantic forest	4.37	0.08	0.00	0.00	0.00	0.00	0.89	0.89	0.00	0.00	0.00	0.00	0.00	0.00
ING 01	Atlantic forest	4.36	0.10	0.01	0.00	0.03	0.00	0.82	0.82	0.00	0.00	0.03	0.00	0.02	0.00
ITM 01	Atlantic forest	4.34	0.05	0.01	0.00	0.01	0.00	0.93	0.93	0.00	0.00	0.00	0.00	0.00	0.00
ITT 02	Atlantic forest	4.52	0.02	0.00	0.00	0.00	0.00	0.97	0.97	0.00	0.00	0.00	0.00	0.01	0.00
LUM 01	Atlantic forest	4.72	0.15	0.02	0.00	0.09	0.00	0.63	0.63	0.00	0.00	0.08	0.00	0.00	0.00
MDD 01	Atlantic forest	4.87	0.00	0.02	0.00	0.02	0.00	0.80	0.80	0.00	0.00	0.13	0.00	0.00	0.00
MTR 01	Atlantic forest	4.60	0.17	0.00	0.00	0.04	0.00	0.76	0.76	0.00	0.00	0.03	0.00	0.00	0.00
NPI 02	Atlantic forest	6.00	0.07	0.00	0.00	0.04	0.00	0.86	0.86	0.00	0.00	0.00	0.00	0.01	0.00
NPI 03	Atlantic forest	5.90	0.05	0.00	0.00	0.08	0.00	0.80	0.80	0.00	0.00	0.00	0.00	0.01	0.00
NPI 04	Atlantic forest	6.21	0.08	0.00	0.00	0.04	0.00	0.81	0.81	0.00	0.00	0.00	0.00	0.01	0.00
NPI 05	Atlantic forest	6.21	0.07	0.00	0.00	0.07	0.00	0.79	0.79	0.00	0.00	0.00	0.00	0.02	0.00
NPI 07	Atlantic forest	5.48	0.01	0.00	0.00	0.04	0.00	0.89	0.89	0.00	0.00	0.00	0.00	0.01	0.00
NPI 08	Atlantic forest	5.46	0.03	0.01	0.00	0.07	0.00	0.86	0.86	0.00	0.00	0.00	0.00	0.01	0.00
NPI 09	Atlantic forest	6.09	0.09	0.01	0.00	0.14	0.00	0.63	0.63	0.01	0.00	0.00	0.00	0.06	0.00
NPI 10	Atlantic forest	5.86	0.08	0.00	0.00	0.11	0.00	0.74	0.74	0.01	0.00	0.00	0.00	0.03	0.00
NSV 01	Atlantic forest	5.65	0.01	0.00	0.00	0.04	0.00	0.89	0.89	0.00	0.00	0.00	0.00	0.04	0.00
NSV 02	Atlantic forest	5.74	0.01	0.00	0.00	0.06	0.00	0.88	0.88	0.00	0.00	0.00	0.00	0.03	0.00
NSV 03	Atlantic forest	5.78	0.00	0.00	0.00	0.00	0.00	0.87	0.87	0.00	0.00	0.00	0.00	0.06	0.00
PIE 01	Atlantic forest	4.57	0.14	0.01	0.00	0.27	0.00	0.48	0.48	0.00	0.00	0.05	0.00	0.00	0.00
POC 01	Atlantic forest	4.15	0.07	0.00	0.00	0.02	0.00	0.85	0.85	0.00	0.00	0.06	0.00	0.00	0.00
RBU 01	Atlantic forest	5.92	0.04	0.08	0.00	0.08	0.00	0.47	0.47	0.00	0.00	0.00	0.00	0.33	0.00
RDO 01	Atlantic forest	5.83	0.01	0.02	0.00	0.22	0.00	0.31	0.31	0.00	0.00	0.02	0.00	0.03	0.00
RDO 02	Atlantic forest	5.70	0.06	0.00	0.00	0.07	0.00	0.78	0.78	0.00	0.00	0.00	0.00	0.06	0.00
CVP 01	Atlantic forest	3.83	0.06	0.00	0.00	0.55	0.00	0.22	0.22	0.00	0.00	0.00	0.00	0.00	0.10
DEC 04	Atlantic forest	5.25	0.32	0.27	0.04	0.26	0.00	0.11	0.11	0.00	0.00	0.00	0.00	0.00	0.00

BAH 04	Caatinga	5.31	0.32	0.15	0.05	0.31	0.00	0.03	0.03	0.00	0.00	0.00	0.03	0.00	0.00
BAH 05	Caatinga	4.84	0.30	0.12	0.00	0.19	0.00	0.24	0.24	0.00	0.00	0.14	0.00	0.00	0.00
BTI 01	Caatinga	5.29	0.78	0.00	0.03	0.06	0.00	0.14	0.14	0.00	0.00	0.00	0.00	0.00	0.00
CGR 01	Caatinga	4.68	0.45	0.00	0.00	0.36	0.00	0.00	0.00	0.00	0.05	0.14	0.00	0.00	0.00
CJU 01	Caatinga	6.48	0.86	0.00	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CTI 01	Caatinga	4.29	0.28	0.07	0.00	0.00	0.00	0.37	0.37	0.00	0.00	0.00	0.00	0.00	0.23
CTT 01	Caatinga	4.65	0.12	0.05	0.00	0.34	0.00	0.26	0.26	0.00	0.01	0.10	0.00	0.00	0.00
CTT 02	Caatinga	4.84	0.22	0.00	0.08	0.07	0.00	0.15	0.15	0.00	0.00	0.44	0.00	0.00	0.02
DEC 03	Caatinga	5.85	0.20	0.17	0.00	0.22	0.00	0.41	0.41	0.00	0.00	0.00	0.00	0.00	0.00
DEC 05	Caatinga	6.50	0.29	0.62	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DEC 06	Caatinga	5.22	0.36	0.17	0.06	0.29	0.00	0.13	0.13	0.00	0.00	0.00	0.00	0.00	0.00
JUV 01	Caatinga	6.11	0.68	0.14	0.00	0.13	0.00	0.05	0.05	0.00	0.00	0.00	0.00	0.00	0.00
LGE 01	Caatinga	5.01	0.19	0.00	0.00	0.29	0.00	0.35	0.35	0.00	0.17	0.00	0.00	0.00	0.00
MCS 01	Caatinga	6.10	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MON 01	Caatinga	5.37	0.40	0.20	0.00	0.09	0.00	0.26	0.26	0.00	0.00	0.00	0.00	0.00	0.00
PFF 01	Caatinga	3.37	0.20	0.00	0.39	0.20	0.00	0.21	0.21	0.00	0.00	0.00	0.00	0.00	0.00
PNP 01	Caatinga	5.89	0.16	0.00	0.00	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.71	0.00	0.00
PSC 01	Caatinga	4.54	0.50	0.00	0.00	0.00	0.00	0.40	0.40	0.00	0.00	0.00	0.00	0.05	0.00
PSC 02	Caatinga	5.39	0.25	0.04	0.00	0.08	0.00	0.57	0.57	0.00	0.00	0.00	0.00	0.02	0.00
PSC 03	Caatinga	4.67	0.72	0.00	0.00	0.00	0.00	0.10	0.10	0.00	0.00	0.00	0.00	0.05	0.00
SCP 01	Caatinga	6.66	0.09	0.00	0.00	0.52	0.00	0.00	0.00	0.00	0.00	0.39	0.00	0.00	0.00
SCP 02	Caatinga	6.07	0.87	0.00	0.00	0.04	0.00	0.09	0.09	0.00	0.00	0.00	0.00	0.00	0.00
CND 01	Caatinga	5.56	0.24	0.00	0.00	0.15	0.00	0.60	0.60	0.00	0.00	0.00	0.00	0.00	0.00
GBR 01	Caatinga	4.69	0.16	0.00	0.00	0.00	0.00	0.60	0.60	0.00	0.00	0.15	0.00	0.00	0.00
GBR 02	Caatinga	5.38	0.30	0.00	0.00	0.00	0.00	0.36	0.36	0.00	0.00	0.33	0.00	0.00	0.00
MOR 01	Caatinga	NA	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MOR 02	Caatinga	5.25	0.00	0.00	0.00	0.00	0.00	0.49	0.49	0.00	0.23	0.29	0.00	0.00	0.00
SET 01	Caatinga	5.44	0.32	0.00	0.00	0.68	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ARI 01	Caatinga	5.07	0.00	0.00	0.00	0.00	0.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
CCZ 02	Cerrado	3.49	0.21	0.02	0.07	0.10	0.00	0.58	0.58	0.00	0.00	0.00	0.00	0.02	0.00
CNO 01	Cerrado	4.61	0.50	0.00	0.00	0.00	0.00	0.41	0.41	0.00	0.00	0.00	0.00	0.00	0.00

CPL 01	Cerrado	5.27	0.28	0.00	0.00	0.00	0.00	0.60	0.60	0.00	0.00	0.00	0.00	0.08	0.00
CPL 02	Cerrado	5.72	0.23	0.00	0.00	0.00	0.00	0.54	0.54	0.00	0.00	0.00	0.00	0.03	0.00
GRM 01	Cerrado	5.31	0.50	0.00	0.00	0.00	0.00	0.47	0.47	0.00	0.00	0.00	0.00	0.03	0.00
GRM 02	Cerrado	3.56	0.38	0.00	0.00	0.34	0.00	0.26	0.26	0.00	0.00	0.00	0.00	0.00	0.02
MTE 01	Cerrado	4.44	0.47	0.00	0.00	0.18	0.00	0.35	0.35	0.00	0.00	0.00	0.00	0.00	0.00
MTE 02	Cerrado	4.30	0.49	0.00	0.00	0.03	0.00	0.42	0.42	0.00	0.00	0.00	0.00	0.00	0.00
NAT 01	Cerrado	4.74	0.53	0.00	0.00	0.00	0.00	0.42	0.42	0.00	0.00	0.03	0.00	0.02	0.00
SEC 01	Cerrado	4.99	0.57	0.03	0.05	0.00	0.00	0.26	0.26	0.00	0.00	0.00	0.00	0.06	0.00
SEC 02	Cerrado	3.22	0.42	0.00	0.00	0.52	0.00	0.03	0.03	0.00	0.00	0.00	0.00	0.00	0.00
SEC 03	Cerrado	5.33	0.35	0.00	0.03	0.00	0.00	0.62	0.62	0.00	0.00	0.00	0.00	0.00	0.00
SEV 02	Cerrado	4.45	0.53	0.01	0.00	0.04	0.00	0.39	0.39	0.00	0.00	0.01	0.00	0.00	0.00
TER 01	Cerrado	5.36	0.27	0.00	0.00	0.00	0.00	0.62	0.62	0.00	0.00	0.00	0.00	0.06	0.00
ALT 01	Cerrado	4.63	0.63	0.00	0.02	0.16	0.00	0.19	0.19	0.00	0.00	0.00	0.00	0.00	0.00
ALT 02	Cerrado	4.75	0.16	0.00	0.03	0.46	0.00	0.23	0.23	0.00	0.00	0.00	0.00	0.00	0.00
CID 02	Cerrado	4.46	0.80	0.00	0.00	0.00	0.00	0.17	0.17	0.00	0.00	0.00	0.00	0.04	0.00
CIP 03	Cerrado	4.55	0.70	0.00	0.00	0.17	0.00	0.12	0.12	0.00	0.00	0.00	0.00	0.00	0.00
CIP 06	Cerrado	5.47	0.32	0.00	0.00	0.17	0.00	0.49	0.49	0.00	0.00	0.00	0.00	0.00	0.02
CIP 09	Cerrado	3.47	0.54	0.00	0.00	0.07	0.00	0.33	0.33	0.00	0.00	0.06	0.00	0.00	0.00
CNO 02	Cerrado	5.05	0.66	0.00	0.00	0.00	0.00	0.27	0.27	0.00	0.00	0.00	0.00	0.07	0.00
CRI 01	Cerrado	4.59	0.38	0.00	0.03	0.21	0.00	0.28	0.28	0.00	0.00	0.05	0.00	0.02	0.00
JRA 01	Cerrado	4.90	0.49	0.00	0.00	0.14	0.00	0.34	0.34	0.00	0.00	0.02	0.00	0.00	0.00
JRA 02	Cerrado	5.40	0.43	0.00	0.00	0.09	0.00	0.43	0.43	0.00	0.00	0.03	0.00	0.02	0.00
MNE 01	Cerrado	4.23	0.29	0.00	0.00	0.02	0.00	0.65	0.65	0.00	0.00	0.00	0.00	0.02	0.00
MRA 01	Cerrado	4.54	0.24	0.01	0.03	0.00	0.00	0.71	0.71	0.00	0.00	0.00	0.00	0.00	0.00
MRA 02	Cerrado	4.73	0.52	0.00	0.00	0.00	0.00	0.48	0.48	0.00	0.00	0.00	0.00	0.00	0.00
NAZ 01	Cerrado	4.59	0.36	0.00	0.00	0.00	0.00	0.61	0.61	0.00	0.00	0.00	0.00	0.02	0.00
NAZ 02	Cerrado	4.45	0.64	0.00	0.00	0.00	0.00	0.31	0.31	0.00	0.00	0.00	0.00	0.02	0.00
PEP 01	Cerrado	5.28	0.16	0.00	0.00	0.00	0.00	0.79	0.79	0.00	0.00	0.00	0.00	0.05	0.00
PEP 02	Cerrado	4.06	0.24	0.00	0.04	0.00	0.00	0.72	0.72	0.00	0.00	0.00	0.00	0.00	0.00
RPT 02	Cerrado	4.41	0.85	0.00	0.00	0.00	0.00	0.15	0.15	0.00	0.00	0.00	0.00	0.00	0.00
RMP 01	Cerrado	4.54	0.19	0.00	0.00	0.13	0.00	0.66	0.66	0.00	0.00	0.00	0.00	0.00	0.00

BON 01	Cerrado	4.63	0.74	0.02	0.00	0.00	0.00	0.24	0.24	0.00	0.00	0.00	0.00	0.00	0.00
DEC 02	Cerrado	4.60	0.31	0.02	0.03	0.14	0.00	0.47	0.47	0.02	0.00	0.02	0.00	0.00	0.00
VEU 01	Cerrado	5.26	0.03	0.00	0.00	0.00	0.00	0.81	0.81	0.00	0.00	0.00	0.00	0.10	0.01