**Appendix S1.** List of robust and informative elevational gradients in ant species richness. Each denoted by study site (reference), diversity pattern (D: decreasing; LP: low-plateau; MP: mid-peak), data scale (L: local; R: regional), survey methods (B: baited traps, F: canopy or bark fogging; H: hand collection; L: litter sifting; M: malaise traps; P: pitfall traps; R: museum records), latitude, mountain base climate, % of gradient sampled, meters unsampled at mountain base, mountain height (m), temperature *r2* values, MDE diversity and range *r2* values, species-area *r2* values, best fit EGCM environmental model, EGCM environmental model *r2* values, EGCM simulation *r2* values, and total number of species and genera on gradient.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | | | | | | | | | | | | | | | |
| **Study Site (Reference)** | **Div. Pattern** | **Scale** | **Survey Methods** | **Lat.** | **Climate** | **% Grad.** | **Unsamp. base (m)** | **Mtn Hgt (m)** | **Temp *r2*** | **MDE Div. *r2*** | **MDE Rng *r2*** | **Area *r2*** | **EGCM best mod** | **EGCM Env. *r2*** | **EGCM Sim. *r2*** | **Species (Genera)** |
| Soutpansberg, South Africa (Munyai & Foord 2012) | D | L | P | -23.0 | Arid | 72.3 | 106 | 938 | 0.745 | --- | --- | 0.887 | --- | --- | --- | 78 (28) |
| Utah, USA (Allred 1982) | MP | R | H | 39.5 | Arid | 78.9 | 52 | 3459 | 0.149 | 0.111 | 0.080 | 0.509 | ATP | 0.698 | 0.969 | 121 (23) |
| Colorado, USA (Gregg 1963) | MP | R | H | 39.0 | Arid | 95.1 | 49 | 3367 | 0.492 | 0.162 | 0.027 | 0.809 | AT | 0.326 | 0.978 | 149 (40) |
| Nevada, USA (Wheeler & Wheeler 1986) | MP | R | H, R | 38.5 | Arid | 92.8 | 9 | 3835 | 0.000 | 0.896 | 0.174 | 0.900 | AT | 0.981 | 0.975 | 157 (28) |
| W. Texas, USA\*\* | MP | R | B, H, L, R | 32.8 | Arid | 92.1 | 0 | 2498 | 0.148 | 0.379 | 0.353 | 0.907 | AP | 0.981 | 0.975 | 149 (35) |
| Chisos Mtns, TX, USA (Van Pelt 1983) | MP | R | B, H, L, R | 29.3 | Arid | 76.2 | 348 | 1706 | 0.007 | 0.406 | 0.417 | 0.002 | TP | 0.855 | 0.968 | 81 (29) |
| Soutpansberg, South Africa (Munyai & Foord 2012) | MP | L | P | -23.0 | Arid | 83.4 | 142 | 1067 | 0.141 | --- | --- | 0.563 | --- | --- | --- | 78 (28) |
| Cederburg Wilderness, South Africa (Botes et al. 2006) | MP | L | P | -32.4 | Arid | 97.8 | 5 | 1964 | 0.000 | --- | --- | 0.004 | --- | --- | --- | 85 (24) |
| Montenegro (Karaman 2011) | D | R | H | 42.3 | Wet | 77.5 | 100 | 2194 | 0.928 | 0.070 | 0.455 | 0.767 | T | 0.794 | 0.283 | 87 (28) |
| McPherson Range, Australia (Burwell & Nakamura 2011) | D | L | F, H, L | -28.2 | Wet | 66.9\* | 300 | 1196 | 0.749 | 0.651 | 0.556 | 0.806 | A | 0.777 | 0.970 | 169 (57) |
| Voralberg, Austria (Glaser 2006) | LP | R | R | 47.3 | Wet | 59.6\* | 12 | 2853 | 0.851 | 0.405 | 0.618 | 0.110 | T | 0.909 | 0.197 | 65 (17) |
| Volcan Barva, Costa Rica (Longino & Colwell 2011) | LP | L | L | 10.3 | Wet | 67.3\* | 50 | 2897 | 0.826 | 0.711 | 0.880 | 0.487 | P | 0.719 | 0.682 | 401 (70) |
| Espinhaco, Brazil (Araujo & Fernandes 2003) | LP | L | B, H | -19.4 | Wet | 56.4\* | 322 | 1241 | 0.775 | 0.950 | 0.406 | 0.773 | T | 0.982 | 0.961 | 39 (15) |
| South Tirol, Italy (Hellrigl 2003) | MP | R | H, R | 46.8 | Wet | 62.6\* | 9 | 3674 | 0.029 | 0.068 | 0.203 | 0.194 | T | 0.189 | 0.922 | 70 (24) |
| Smoky Mtns, TN, USA (Lessard et al. 2007) | MP | L | L, M, P | 35.6 | Wet | 75.4 | 161 | 1807 | 0.701 | 0.102 | 0.625 | 0.845 | ATP | 0.727 | 0.953 | 38 (20) |
| Mt Isarog, Philippines (Samson et al 1997) | MP | L | P, H | 13.7 | Wet | 75.6 | 250 | 1983 | 0.593 | 0.190 | 0.368 | 0.373 | A | 0.575 | 0.971 | 52 (20) |
| Western Ghats, India (Sabu et al. 2008) | MP | L | L | 11.7 | Wet | 58.1\* | 300 | 2322 | 0.205 | 0.026 | 0.811 | 0.543 | A | 0.200 | 0.845 | 29 (18) |
| Bocas del Toro, Panama (Olson 1994) | MP | L | L, P | 8.8 | Wet | 58.1\* | 300 | 2375 | 0.799 | --- | --- | 0.686 | --- | --- | --- | 196 (-) |
| Ambohitsitondroina, Madagascar (Fisher 1998) | MP | L | L, P | -15.1 | Wet | 95.5 | 25 | 2053 | 0.506 | 0.177 | 0.067 | 0.684 | A | 0.349 | 0.988 | 272 (28) |
| Fiji (Sarnat & Economo 2012) | MP | R | ALL | -17.7 | Wet | 98.1 | 0 | 1324 | 0.654 | 0.359 | 0.096 | 0.850 | A | 0.579 | 0.914 | 174 (42) |

\* < 70% of gradient sampled, but primarily upper elevations where diversity had already decreased monotonically

\*\* Moody & Francke 1982; Cockendolpher & Francke 1990

**Appendix S1: References**

Allred, D.M. (1982) Ants of Utah. *The Great Basin Naturalist*, **42**, 415–511.

Araújo, L.M. & Fernandes, G.W. (2003) Altitudinal patterns in a tropical ant assemblage and variation in species richness between habitats. *Lundiana*, **4**, 103–109.

Botes, A., McGeoch, M.A., Robertson, H.G., van Niekerk, A., Davids, H.P. & Chown, S.L. (2006) Ants, altitude and change in the northern Cape Floristic Region. *Journal of Biogeography*, **33**, 71–90.

Burwell, C.J. & Nakamura, A. (2011) Distribution of ant species along an altitudinal transect in continuous rainforest in subtropical Queensland, Australia. *Memoirs of the Queensland Museum*, **55**, 391–412.

Cokendolpher, J.C. & Francke, O.F. (1990) *The ants (Hymenoptera, Formicidae) of western Texas. Part II. Subfamilies Ecitoninae, Ponerinae, Pseudomyrmecinae, Dolichoderinae, and Formicinae*, Texas Tech Press, Lubbock, TX.

Fisher, B.L. (1998) Ant diversity patterns along an elevational gradient in the Réserve Spéciale d’Anjanaharibe-Sud and on the western Masoala Peninsula, Madagascar. *Fieldiana Zoology*, **90**, 39–67.

Glaser, F. (2006) Biogeography, diversity, and vertical distribution of ants (Hymenoptera: Formicidae) in Vorarlberg, Austria. *Myrmecological News*, **8**, 263–270.

Gregg, R.E. (1963) *The ants of Colorado*, University of Colorado Press, Denver, CO.

Hellrigl, K. (2003) Faunistik der Ameisen und Wildbienen Südtirols (Hymenoptera: Formicidae et Apoidea). *Gredleriana*, **3**, 143–208.

Karaman, M.G. (2011) Zoogeography, diversity and altitudinal distribution of ants (Hymenoptera: Formicidae) in the Mediterranean and the oro-Mediterranean parts of Montenegro. *North-Western Journal of Zoology*, **7**, 26–34.

Lessard, J.P., Dunn, R.R., Parker, C.R. & Sanders, N.J. (2007) Rarity and diversity in forest ant assemblages of Great Smoky Mountains National Park. *Southeastern Naturalist*, **6**, 215–228.

Longino, J.T. & Colwell, R.K. (2011) Density compensation, species composition, and richness of ants on a neotropical elevational gradient. *Ecosphere*, **2**, art29.

Moody, J.V. & Francke, O.F. (1982) *The ants (Hymenoptera, Formicidae) of western Texas Part I. Subfamily Myrmicinae*, Texas Tech Press, Lubbock, TX.

Munyai, T.C. & Foord, S.H. (2011) Ants on a mountain: spatial, environmental and habitat associations along an altitudinal transect in a centre of endemism. *Journal of Insect Conservation*, **16**, 677–695.

Olson, D.M. (1994) The distribution of leaf litter invertebrates along a neotropical altitudinal gradient. *Journal of Tropical Ecology*, **10**, 129–150.

Van Pelt, A. (1983) Southwestern Association of Naturalists Ants of the Chisos Mountains, Texas (Hymenoptera: Formicidae). *The Southwestern Naturalist*, **28**, 137–142.

Sabu, T.K., Vineesh, P. & Vinod, K. (2008) Diversity of forest litter-inhabiting ants along elevations in the Wayanad region of the Western Ghats. *Journal of Insect Science*, **8**, 1–14.

Samson, D.A., Rickart, E.A. & Gonzales, P.C. (1997) Ant diversity and abundance along an elevational gradient in the Phillippines. *Biotropica*, **29**, 349–363.

Sarnat, E. & Economo, E. (2012) *The ants of Fiji*, UC Publications in Entomology, University of California Press, Berkeley and Los Angeles, CA.

Wheeler, G. & Wheeler, J. (1986) *The ants of Nevada*, Natural History Museum of Los Angeles County, Los Angeles, CA.

**Appendix S2.** Datasets that were not used in analyses, including the study site (reference), the reported diversity pattern (D: decreasing; I: Increasing; LP: low-plateau; MP: mid-peak, and No Pattern), the data scale (local or regional), and the reason(s) the study was not included (D: large portion of gradient had anthropogenic disturbance; G: sampling gaps between sites were >500m; I: insufficient or no elevational diversity data; L: no sampling in the lowest 400m; M: multiple gradients or sites too far apart; P: <70% of elevational gradient sampled and not primarily upper elevaitons where diversity had already decreased monotonically; R: repeated data or non-independent transect; S: sampling effort minimal or biased elevationally).

|  |  |  |  |
| --- | --- | --- | --- |
| **Study Site (Reference)** | **Reported Pattern** | **Scale** | **Reason for Exclusion** |
| Alps, Tirol, Austria (Kofler 1978) | --- | Regional | I |
| Andes, Colombia (van der Hammen & Ward 2005) | MP | Local | L, S |
| Andes, Lambayeque, Peru (Delgado et al. 2008) | D | Local | L, P, S |
| Andes, Venezuela (Janzen 1976) | LP | Local | G |
| Andohahela, Madagascar (Fisher 1999) | MP | Local | P |
| Andringitra, Madagascar (Fisher 1996) | D | Local | L, P |
| Appalachian Mtns, NC, VA, MD; USA (McCoy 1990) | --- | Local | I |
| Appalachian Mtns, VA, USA (Wang et al. 2001) | D | Local | I |
| Cederburg Wilderness, South Africa (Botes et al. 2006) | MP | Local | L |
| Chiricahua Mtns, AZ, USA (Anderson 1997) | MP | Local | S |
| Colorado, USA (Sanders 2002) | MP | Regional | R |
| Coastal Cordillera, Venezuela (Lattke & Riera-Valera 2012) | --- | Local | L, P |
| Costa Rica (Janzen 1973) | --- | Local | G |
| Eastern Australia (Majer et al. 2001) | D | Local | G, M |
| Georgia (Chaladze 2012) | MP | Regional | I |
| Georgia, USA (Ipser et al. 2004) | MP | Regional | S |
| Gunung Mulu, Sarawak (Collins 1980) | --- | Local | I |
| Himalayas, India (Bharti 2008) | --- | Regional | I, L |
| Himalayas, Jammu-Kashmir, India (Bharti & Sharma 2009) | --- | Local | G, L, P |
| Himalayas, Jammu-Kashmir, India (Bharti et al. 2013) | MP | Local | G |
| Imatong Mtns, Sudan (Weber 1943) | --- | Local | I |
| Kinabalu, Malaysia (Brühl et al. 1999) | D | Local | L, S |
| Kinabalu, Malaysia (Malsch et al. 2008) | D | Local | L |
| Manongarivo, Madagascar (Fisher 2002) | LP | Local | S |
| Minorca, Spain (Guillem 2009) | --- | Local | P |
| Monts Doudou, Gabon (Fisher 2004) | No Pattern | Local | D, S |
| Nevada, USA (Sanders 2002) | MP | Regional | R |
| Northeastern USA (Del Toro 2013) | --- | Local | M |
| Okinawa, Japan (Ito et al. 1998) | --- | Local | P, S |
| Shoshone Mtns, NV, USA (MontBlanc et al. 2007) | MP | Local | L, P |
| Sierra Nevada de Santa Marta, Colombia (Guerrero & Sarmiento 2010) | D | Local | L, P |
| Smoky Mtns, TN, USA (Cole 1940) | LP | Regional | R |
| Smoky Mtns, TN, USA (Geraghty et al. 2007) | D | Local | R |
| Smoky Mtns, TN, USA (Sanders et al. 2007) | D | Local | R |

|  |  |  |  |
| --- | --- | --- | --- |
| **Study Site (Reference)** | **Reported Pattern** | **Scale** | **Reason for Exclusion** |
| Smoky Mtns, TN, USA (Whittaker 1952) | --- | Local | I |
| Smoky Mtns, TN, USA (Zelikova et al. 2008) | D | Local | I, R |
| South Korea (Kwon et al. 2014) | D | Local | S |
| South Sinai, Egypt (Orabi et al. 2011) | No Pattern | Local | G |
| South Tirol, Italy (Glaser 2008) | --- | Regional | I |
| Spring Mtns, NV, USA (Sanders 2003) | I | Local | P |
| Spring Mtns, NV, USA (Sanders 2003) | I | Local | P |
| Spring Mtns, NV, USA (Sanders 2003) | MP | Local | P |
| Tatra Mtns, Poland (Woyciechowski 1993) | --- | Local | I, L, P |
| Utah, USA (Sanders 2002) | MP | Regional | R |
| Volcan Barva, Costa Rica (Atkin & Proctor 1988) | --- | Local | I |
| Volcan Barva, Costa Rica (Colwell et al. 2008) | LP | Local | R |

**Appendix S2: References**

Andersen, A.N. (1997) Functional groups and patterns of organization in North American ant communities: a comparison with Australia. *Journal of Biogeography*, **24**, 433–460.

Atkin, L. & Proctor, J. (1988) Invertebrates in the litter and soil on Volcan Barva, Costa Rica. *Journal of tropical ecology*, **4**, 307–310.

Bharti, H. (2008) Altitudinal diversity of ants in Himalayan regions (Hymenoptera: Formicidae). *Sociobiology*, **52**, 305–322.

Bharti, H. & Sharma, Y.P. (2009) Diversity and abundance of ants along an elevational gradient in Jammu-Kashmir Himalaya-I. *Halteres*, **1**, 10–24.

Bharti, H., Sharma, Y.P., Bharti, M. & Pfeiffer, M. (2013) Ant species richness, endemicity and functional groups, along an elevational gradient in the Himalayas. *Asian Myrmecology*, **5**, 79–101.

Botes, A., McGeoch, M.A., Robertson, H.G., van Niekerk, A., Davids, H.P. & Chown, S.L. (2006) Ants, altitude and change in the northern Cape Floristic Region. *Journal of Biogeography*, **33**, 71–90.

Bruhl, C.A., Mohamed, M. & Linsenmair, K.E. (1999) Altitudinal distribution of leaf litter ants along a transect in primary forests on Mount Kinabalu, Sabah, Malaysia. *Journal of Tropical Ecology*, **15**, 265–277.

Castro Delgado, S., Vergara Cobian, C. & Arellano Ugarte, C. (2008) Distribucion de la riqueza, composicion taxonomica y grupos funcionales de hormigas del suelo a lo largo de un gradiente altitudinal en el Refugio de Vida Silvestre Laquipampa, Lambayeque - Peru. *Ecologia Aplicada*, **7**, 89–103.

Chaladze, G. (2012) Climate-based model of spatial pattern of the species richness of ants in Georgia. *Journal of Insect Conservation*, **16**, 791–800.

Cole, A. (1940) A guide to the ants of the Great Smoky Mountains National Park, Tennessee. *American Midland Naturalist*, **24**, 1–88.

Collins, N. (1980) The distribution of soil macrofauna on the west ridge of Gunung (Mount) Mulu, Sarawak. *Oecologia*, **44**, 263–275.

Colwell, R., Brehm, G. & Cardelús, C. (2008) Global warming, elevational range shifts, and lowland biotic attrition in the wet tropics. *Science*, **322**, 258–261.

Del Toro, I. (2013) Diversity of Eastern North American ant communities along environmental gradients. *PloS One*, **8**, e67973.

Fisher, B.L. (1999) Ant diversity patterns along an elevational gradient in the Réserve Naturelle Intégrale d’Andohahela, Madagascar. *Fieldiana Zoology*, **94**, 129–147.

Fisher, B.L. (1996) Ant diversity patterns along an elevational gradient in the Réserve Naturelle Intégrale d’Andringitra, Madagascar. *Fieldiana Zoology*, **85**, 93–108.

Fisher, B.L. (2002) Ant diversity patterns along an elevational gradient in the Réserve Spéciale de Manongarivo, Madagascar. *Boissiera*, **59**, 311–328.

Fisher, B.L. (2004) Diversity patterns of ants (Hymenoptera: Formicidae) along an elevational gradient on Monts Doudou in Southwestern Gabon. *California Academy of Sciences Memoir*, **28**, 269–286.

Geraghty, M.J., Dunn, R.R. & Sanders, N.J. (2007) Body size, colony size, and range size in ants (Hymenoptera: Formicidae): are patterns along elevational and latitudinal gradients consistent with Bergmann’s rule. *Myrmecological News*, **10**, 51–58.

Glaser, F. (2008) Die Ameisenfauna (Hymenoptera, Formicidae) des Schlerngebiets (Italien, Sudtirol). *Gredleriana*, **8**, 467–496.

Guerrero, R.J. & Sarmiento, C.E. (2010) Distribucion altitudinal de hormigas (Hymenoptera, Formicidae) en la vertiente noroccidental de la Sierra Nevada de Santa Marta (Colombia). *Acta Zoologica Mexicana*, **26**, 279–302.

Guillem, R. (2009) A survey of the ants of Minorca (Hymenoptera: Formicidae) with two new species for the island: Hypoponera punctatissima (Roger, 1859) and Temnothorax algiricus (Forel, 1894). *Boletín de la Asociación Española de Entomología*, **33**, 447–460.

Ipser, R.M., Brinkman, M.A., Gardner, W.A. & Peeler, H.B. (2004) A survey of ground-dwelling ants (Hymenoptera: Formicidae) in Georgia. *Florida Entomologist*, **87**, 253–260.

Ito, Y., Takamine, H. & Yamauchi, K. (1998) Abundance and species diversity of ants in forests of Yanbaru, the Northern Part of Okinawa Honto with special reference to effects of undergrowth removal. *Entomological Science*, **1**, 347–355.

Janzen, D. (1973) Sweep Samples of Tropical Foliage Insects : Description of Study Sites , With Data on Species Abundances and Size Distributions. *Ecology*, **54**, 659–686.

Janzen, D., Ataroff, M., Farinas, M. & Reyes, S. (1976) Changes in the arthropod community along an elevational transect in the Venezuelan Andes. *Biotropica*, **8**, 193–203.

Janzen, D.D.H. (1973) Sweep samples of tropical foliage insects: effects of seasons, vegetation types, elevation, time of day, and insularity. *Ecology*, **54**, 687–708.

Kofler, A. (1978) Faunistik der Ameisen (Insecta: Hymenoptera, Formicoidea) Osttirols (Tirol, Österreich). *Ber. nat.-med. Verein Innsbruck*, 117–128.

Kwon, T.-S., Kim, S.-S., & Chun, J.H. (2014) Pattern of ant diversity in Korea: An empirical test of Rapoport's altitudinal rule. *Journal of Asia-Pacific Entomology*.

Lattke, J.E. & Riera-valera, M.A. (2012) Diversidad de hormigas (Hymenoptera: Formicidae) en la hojarasca y suelo de selvas nubladas de la Cordillera de la Costa, Venezuela. *Metodos en Ecologia y Sistematica*, **7**, 20–34.

Majer, J.D., Kitching, R.L., Heterick, B.E. & Hurley, K. (2001) North-south patterns within arboreal ant assemblages from rain forests in eastern Australia. *Biotropica*, **33**, 643–661.

Malsch, A.K.F., Fiala, B., Maschwitz, U., Mohamed, M., Nais, J. & Linsenmair, K. (2008) An analysis of declining ant species richness with increasing elevation at Mount Kinabalu, Sabah, Borneo. *Asian Myrmecology*, **2**, 33–49.

McCoy, E.D. (1990) The distribution of insects along elevational gradients. *Oikos*, **58**, 313–322.

MontBlanc, E.M., Chambers, J.C. & Brussard, P.F. (2007) Variation in ant populations with elevation, tree cover, and fire in a pinyon-juniper-dominated watershed. *Western North American Naturalist*, **67**, 469–491.

Orabi, G.M., Semida, F.M., Abdel-Dayem, M.S., Sharaf, M.R. & Zalat, S.M. (2011) Diversity patterns of ants along an elevation gradient at St. Catherine Protectorate, South Sinai, Egypt. *Zoology in the Middle East*, **54**, 101–112.

Robertson, H.G. (2002) Comparison of leaf litter ant communities in woodlands, lowland forests and montane forests of north-eastern Tanzania. *Biodiversity and Conservation*, **11**, 1637–1652.

Sanders, N.J. (2002) Elevational gradients in ant species richness: area, geometry, and Rapoport’s rule. *Ecography*, **1**, 25–32.

Sanders, N.J., Lessard, J.-P., Fitzpatrick, M.C. & Dunn, R.R. (2007) Temperature, but not productivity or geometry, predicts elevational diversity gradients in ants across spatial grains. *Global Ecology and Biogeography*, **16**, 640–649.

Sanders, N.J., Moss, J. & Wagner, D. (2003) Patterns of ant species richness along elevational gradients in an arid ecosystem. *Global Ecology and Biogeography*, **12**, 93–102.

Van der Hammen, T. & Ward, P. (2005) Ants from the Ecoandes expeditions: diversity and distribution. *Studies on Tropical Andean Ecosystems*, **6**.

Wang, C., Strazanac, J.S. & Butler, L. (2001) Association between ants (Hymenoptera: Formicidae) and habitat characteristics in oak-dominated mixed forests. *Environmental Entomology*, **30**, 842–848.

Weber, N.A. (1943) The ants of the Imatong Mountains, Anglo-Egyptian Sudan. *Bulletin of the Museum of Comparative Zoology*, **93**, 263–389.

Whittaker, R.H. (1952) A study of summer foliage insect communities in the Great Smoky Mountains. *Ecological Monographs*, **22**, 1–44.

Woyciechowski, M. (1993) Ants (Hymenoptera, Formicidae) of the glades in the Tatra Mts (the Carpathians). *Tiscia*, **27**, 17–22.

Zelikova, T.J., Dunn, R.R. & Sanders, N.J. (2008) Variation in seed dispersal along an elevational gradient in Great Smoky Mountains National Park. *Acta Oecologica*, **34**, 155–162.