**Table 1.** Description of the variables included in the Litterfall\_Mass.csv file.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Variable** | **Definition** | **Unit** | **N** | **Range or Categorical levels** |
| Author | Publication authors | N/A | 22 | Listed in Bomfim et al. manuscript Table S2 |
| Study\_ID | Unique identification number of each study | N/A | 22 | 4 – 56 |
| Effectsize\_ID | Unique identification number of each observation | N/A | 2367 | 1 – 2367 |
| Case\_ID | Unique identification number of each case study | N/A | 60 | 4.1 – 56.1 |
| Year | Publication year | N/A | 15 | 1980 – 2018 |
| Basin\_ID | Unique identification number of each tropical cyclone basin | N/A | 4 | 1 – 4 |
| Basin | Tropical cyclone basin in which the study was conducted | N/A | 4 | North Atlantic, Northeast Pacific, Northwest Pacific, Southwest Pacific |
| Region\_ID | Unique identification number of each tropical region | N/A | 5 | 1 – 5 |
| Region | Tropical region in which the study was conducted | N/A | 5 | Australia, Caribbean, Hawaii, Mexico, Taiwan |
| Country\_ID | Unique identification number of each tropical area | N/A | 8 | 1 – 8 |
| Country | Tropical country included in this database, considering Hawaii and Puerto Rico as individual countries | N/A | 8 | Australia, Central Taiwan, Guadeloupe, Puerto Rico, Hawaii, Quintana roo, Jalisco, Central Taiwan, and Southern Taiwan |
| Site\_ID | Unique identification number of each site | N/A | 26 | 1 – 26 |
| Site | Site name extracted from the original published article or data set | N/A | 26 | Birthday creek, Bisley, Bisley-El Verde, Chamela-Cuixmala, Cubuy, East Peak, El Verde, Gadgarra, Grande-Terre, Guanica, Guayama, Halemanu, Kengting III, Kengting IV, Kokee, Kumuwela, Lienhuachi, Makaha 1, Mt Spec, Mt Spec disturbed, Rio Abajo, San Felipe, Utuado, Wooroonooran basalt, and Wooroonooran schist |
| Forest\_type | Type of forest ecosystem as described in the published article or data set | N/A | 16 | Acacia koa, Cloud, Colorado, Complex Mesophyll Vine, Deciduous dry, Evergreen broadleaf, Moist, Montane rain, Palm, Semideciduous dry, Short Cloud, Simple Notophyll Vine, Subtropical moist, Tabonuco, Tall Cloud, and Tropical upland rain |
| Holdridge\_life\_zone | Classification of forest type sensu Holdridge life zone system | N/A | 9 | Subtropical dry, Subtropical lower montane rain, Subtropical lower montane wet, Subtropical lower montane moist, Subtropical moist, Subtropical premontane dry, Subtropical wet, Tropical dry, and Tropical moist |
| Latitude | Latitude of study site extracted from published article or data set metadata or Google Earth | UTM | 2367 | -19 – 23.9 |
| Longitude | Longitude of study site extracted from published article or data set metadata or Google Earth | UTM | 2367 | -159.71744 – 146.1718421 |
| Elevation\_m | Elevation of study site extracted from the original published article or data set | m | 2367 | 60 – 1134 |
| MAP\_mm | Mean annual precipitation extracted from the original or related published article or data set | mm | 2367 | 800 – 4735 |
| MAT\_C | Mean annual temperature extracted from the original or related published article or data set | ºC | 2367 | 16 – 27.7 |
| MAT\_MAP\_x100 | Ratio of MAT to MAP multiplied by 100 | ºC/mm x 100 | 2367 | 0.4 – 3.2 |
| Rock\_type\_ID | Unique identification number of each geological group to which the soil parent material pertains | N/A | 7 | 1 – 7 |
| Rock\_type | Geological group of the soil parent material (Porder & Ramachandran, 2013) | N/A | 7 | Acid volcanic, Basalt, Basic Intermediate Volcanic, Carbonate, Sandstone, Shale, Shield |
| RockP\_ID | Unique identification number of each phosphorus class to which the geological group pertains | N/A | 3 | 1 – 3 |
| RockP\_class | Rock phosphorus group of the soil parent material (Porder & Ramachandran, 2013) | N/A |  | Low, Intermediate and High |
| Par\_Mat\_ID | Unique identification number of each soil parent material | N/A | 14 | 1 – 14 |
| Par\_Mat | Soil parent material extracted from original or related published article or data set | N/A | 14 | Acid volcanic, Basalt, Granite, HA Volcaniclastic, Hengchun Limestone, Limestone, Metamorphic schist, Noncarbonate sedimentary, Residuum Coluviuum Volcanic, Quartzitic sandstone, Rhyolitic rhyodacitic volcanic, Volcanic ash, Volcanic siltstone, and Volcaniclastic |
| Soil\_ID | Unique identification number of each soil order | N/A | 7 | 1 – 7 |
| USDA\_Soil\_order | Soil order classification sensu USDA taxonomy | N/A | 7 | Alfisol, Andisol, Inceptisol, Entisol, Mollisol, Ultisol, and Oxisol |
| Hedley\_totalsoilP\_Bicarb\_OH\_Pt | Total soil P as the sum of Po and Pi from Hedley fractionation | mg/kg | 1459 | 21 – 397 |
| Other\_soil\_P | Total soil P extracted from acid digestion and reported in original or related published article or data set. Data sources listed in Table 2. | mg/kg | 2367 | 20 – 2900 |
| Treatment\_ID | Unique identification number of each treatment condition under which the study was conducted | N/A | 8 | 1 – 8 |
| Treatment | Treatment condition under which the study was conducted | N/A | 8 | Ambient, Debris removal, full fertilization, N fertilization, P fertilization, N and P fertilization, Canopy trimming, Canopy trimming and Debris addition |
| Fraction | Litterfall fraction measured in original published article or data set | N/A | 5 | Total litterfall, Leaf fall, Fine wood fall (< 2 cm diameter), FFS fall (fruits, flowers and seeds), Miscellaneous fall |
| Raw\_Unit | Unit of the litterfall mass flux data extracted from original published article or data set | g/m2/day | 1 | g/m2/day |
| Gale\_wind\_duration\_minutes | Estimated gale wind duration at specific site location calculated using the HURRECON model. Gale wind is defined as wind speed higher than 17.5 m/s. | minutes | 2346 | 80 – 6040 |
| Fujita\_scale | Fujita scale generated by the HURRECON model | N/A | 7 | 1 – 7 |
| StormFrequencyNorm | Total number of storms listed for the site-specific 1-degree grid in IBTrACS from 1955 until the cyclone year divided by the number of years between 1955 and 2020 | storms/year | 2367 | 0.14 – 0.94 |
| YearsSinceLastStorm | Time since the last storm listed in 1 degree grid, considering the year the cyclone of the respective case study occurred | years | 2367 | 0.03 – 12.1 |
| DisturbanceYear | The year when the cyclone occurred | N/A | 2367 | 1977 – 2017 |
| DisturbanceName | The name of the tropical cyclone extracted from the original published article or data set | N/A | 23 | Aivu, Bertha, Charlie, CTE, Fungwong, Georges, Gilbert, Haima, Hugo, Iniki, Irma, Maria, Ivor, Jangmi, Jova, Kalmaegi, Keith, Larry, Luis, Mindulle, Nanmadol, Patricia, Sinlaku |
| DisturbanceClass | The tropical cyclone disturbance class according to the IBTrACS classification | N/A | 8 | Hurricane, Major hurricane, Tropical cyclone, Tropical storm, Severe tropical cyclone, Typhoon, Super typhoon, Simulated |
| DisturbanceDate | Date when the tropical cyclone occurred | N/A | 20 | 30-Jan-77 – 20-Sep-17 |
| Distance\_to\_Disturb\_km | Distance between the forest site and the center of cyclone trac. Extracted from original published article or using WebPlotDigitizer to measure distance using the cyclone track image and the site latitude and longitude | km | 2367 | 3 – 222 |
| Disturb\_Rainfall\_mm | The amount of rainfall associated with the tropical cyclone. Extracted from original published article or NOAA cyclone report | mm | 2367 | 10 – 860 |
| HURRECON\_wind\_ms | Site peak wind speed calculated as a function of cyclone position, cyclone speed and direction, maximum sustained wind speed, wind profile constant, and surface type using the HURRECON model | m/s | 2346 | 18 – 63 |
| WMO\_wind\_ms | WMO wind speed of respective tropical cyclone at the closest latitude and longitude to the site. Extracted from IBTrACS | m/s | 2367 | 11.3 – 77.2 |
| WMO\_press\_mb | WMO wind pressure of respective tropical cyclone at the closest latitude/longitude to the site. Extracted from IBTrACS | mb | 2367 | 900 – 1001 |
| TSD\_months | Time since cyclone disturbance extracted from original published article or data set | months | 2367 | 0.1 – 86 |
| Cat\_TSD\_months | Classification of time since disturbance in two categories to calculate the resistance and resilience indices. 0-0.5 included all effect size IDs with a time since disturbance lower or equal to 0.5, and Rec including all other effect size IDs | N/A | 2 | 0-0.5 and Rec. |
| Post\_Mean | The mean of the litterfall variable after the cyclone occurred.Extracted from the original published article or data set | g/m2/day | 2367 | 0.01 – 4980 |
| Post\_SD | The standard deviation of the mean of the litterfall variable after the cyclone occurred.  Extracted from the original published article or data set | g/m2/day | 2367 | 0.01 – 3876.6 |
| Pre\_Mean | The long-term mean of the litterfall variable before the cyclone occurred. Extracted from the original published article or data set | g/m2/day | 2367 | 0.025 – 7.05 |
| Pre\_ SD | The standard deviation of the long-term mean of the litterfall variable before the cyclone occurred. Extracted from the original published article or data set | g/m2/day | 2367 | 0.01 – 6.46 |
| S\_size | The sample size (number of litterfall baskets) extracted from the original published article or data set | Litterfall baskets | 2367 | 7 – 3300 |
| PostMonth | The month for which the subannual litterfall data was extracted from the original or related publication | N/A | 12 | January – December |
| Pre\_Mean\_MonthSpecific | The month-specific mean of the litterfall variable before the cyclone occurred extracted from the original publication | g/m2/day | 1956 | 0.005 – 13 |
| Pre\_SD\_MonthSpecific | The month-specific standard deviation of the mean of the litterfall variable after the cyclone occurred extracted from the original publication | g/m2/day | 1956 | 0.01 – 17.42 |

**Compiled moderator variable metadata and compilation methods**

For each case study, we compiled soil, geology, disturbance, forest and site variables — listed in Table 1.

Soil phosphorus, parent material and taxonomy *—* We extracted total soil phosphorus concentration from text, figures, tables or appendices of the published articles, metadata in case of data sets, or directly from the published data sets or authors — listed in Table 2. We transformed the original phosphorus concentration data into mg kg-1 for all case studies included in our database. Total soil phosphorus concentration in Grande-Terre was estimated to be 10 times greater (Duxbury et al., 1989) than the available soil phosphorus concentration, whose value was provided by Dr. Daniel Imbert as personal communication. The total soil phosphorus concentration in four sites in Hawaii (Makaha 1, Milolii, Kumuwela and Halemanu) were also estimated to be 10 times greater (Vitousek et al., 2003) than the available phosphorus concentrations obtained from the original published study (Table 2).

We grouped parent materials according to their phosphate sorption. This sorption should be highest in the soils of basaltic origin, lowest in those derived from granitic parent materials, and intermediate in those derived from metamorphic rock parent materials (Porder & Ramachandran, 2013). Soil order information, according to the USDA soil taxonomy (Soil Survey Staff, 1999), was collected from the original or related published articles, or using the Web Soil Survey (<http://websoilsurvey.sc.egov.usda.gov/>) for a few sites in Puerto Rico and Hawaii (Table 2). Seven soil order categories, out of the twelve possible categories in this system, were included in our compiled database, namely: Entisol, Inceptisol, Andisol, Alfisol, Mollisol, Ultisol, and Oxisol. Some of these soil types represent only a small fraction of all similar soils across the globe. For instance, only 4% of all Mollisols are in the tropical region, while others like Ultisol and Oxisols are the highly-weathered, nutrient-poor soils commonly underlying tropical forests (Buol et al., 2011).

Cyclone disturbance data *—* We extracted historical tropical cyclone data for each cyclone event included in our database from the National Oceanic and Atmospheric Administration’s International Best Track Archive for Climate Stewardship (IBTrACS; (Knapp et al., 2010). A longer historical cyclone data was available for some sites, especially Puerto Rico (Boose et al., 2004), but 1955 was the start of the storm record at IBTrACS for many sites in our database. The cyclone data extracted from IBTrACS included: storm frequency — the number of storm events registered for each site at 1 degree resolution between 1955 and 2020; WMO wind speed (m s-1); WMO wind pressure (mb); distance from the site to the cyclone track (km) measured with the web application WebPlotDigitizer (Rohatgi, 2015). We also obtained site-level wind speed and gale wind duration data through HURRECON for almost all case studies included in our meta-analysis. Two case studies involving cyclones Keith and Haima did not have wind speed data through HURRECON due to minimum wind speed thresholds set up in the model. Cyclone rainfall (Hall et al., 2020) was obtained from various sources, including the rainfall data (NOAA, https://water.weather.gov/precip/download.php) for the day of cyclone Maria landfall in Puerto Rico and the following day (September 20–21, 2017), as well as the day of cyclone Irma landfall (September 6–7, 2017), including that which fell during Hurricane Irma (on September 6th). Data for cyclone Maria was obtained from (Keellings & Hernández Ayala, 2019).

**Table 2.** References for soil and cyclone data for the case studies compiled in the litterfall mass and nutrient datasets.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Study** | **Site** | **Cyclone name and year** | **Soil P** | **Soil order and parent material** | **Storm Frequency** | **Cyclone wind speed and pressure** | **Cyclone rainfall** |
| (S. M. Gleason et al., 2008) | Wooroonooran 1 | Larry 2006 | (S. Gleason et al., 2009) | (S. M. Gleason et al., 2008) | http://ibtracs.unca.edu/index.php?name=Grid-26065 | http://ibtracs.unca.edu/index.php?name=v04r00-2006074S13158 | https://web.archive.org/web/20060418053332/http://www.bom.gov.au/weather/qld/cyclone/tc\_larry/ |
| (S. M. Gleason et al., 2008) | Wooroonooran 2 | Larry 2006 | (S. Gleason et al., 2009) | (S. M. Gleason et al., 2008) | http://ibtracs.unca.edu/index.php?name=Grid-26065 | http://ibtracs.unca.edu/index.php?name=v04r00-2006074S13158 | https://web.archive.org/web/20060418053332/http://www.bom.gov.au/weather/qld/cyclone/tc\_larry/ |
| (Herbohn & Congdon, 1993) | Mt. Spec | Charlie 1988 | (Herbohn & Congdon, 1993) | (Herbohn & Congdon, 1993) | http://ibtracs.unca.edu/index.php?name=Grid-25706 | http://ibtracs.unca.edu/index.php?name=v04r00-1988050S13155 | (Herbohn & Congdon, 1993) |
| (Herbohn & Congdon, 1993) | Mt. Spec disturbed | Charlie 1988 | (Herbohn & Congdon, 1993) | (Herbohn & Congdon, 1993) | http://ibtracs.unca.edu/index.php?name=Grid-25706 | http://ibtracs.unca.edu/index.php?name=v04r00-1988050S13155 | (Herbohn & Congdon, 1993) |
| (Benson & Pearson, 1993) | Birthday Creek | Charlie 1988 | (Spain, 1990) | (Spain, 1990) | http://ibtracs.unca.edu/index.php?name=Grid-25706 | http://ibtracs.unca.edu/index.php?name=v04r00-1988050S13155 | (Congdon & Herbohn, 1993) |
| (Benson & Pearson, 1993) | Birthday Creek | Aivu 1989 | (Spain, 1990) | (Spain, 1990) | http://ibtracs.unca.edu/index.php?name=Grid-25706 | http://ibtracs.unca.edu/index.php?name=v04r00-1988050S13155 | http://www.bom.gov.au/cyclone/history/aivu.shtml |
| (Benson & Pearson, 1993) | Birthday Creek | Ivor 1990 | (Spain, 1990) | (Spain, 1990) | http://ibtracs.unca.edu/index.php?name=Grid-25706 | http://ibtracs.unca.edu/index.php?name=v04r00-1988050S13155 | bom.gov.au/cyclone/nt/Ivor.shtml |
| (Brasell et al., 1980) | Gadgarra | Keith 1977 | (Brasell et al., 1980) | (Brasell et al., 1980) | http://ibtracs.unca.edu/index.php?name=Grid-26065 | http://ibtracs.unca.edu/index.php?name=v04r00-1977030S15148 | (Brasell et al., 1980) |
| (Zimmerman et al., 1995) | El Verde (Ambient, DebRem & Fert) | Hugo 1989 | (Johnson & H. Xing, 2020) | https://soilseries.sc.egov.usda.gov/OSD\_Docs/Z/ZARZAL.html | http://ibtracs.unca.edu/index.php?name=Grid-39174 | http://ibtracs.unca.edu/index.php?name=v04r00-1989254N13340 | (Scatena & Larsen, 1991) |
| (Walker et al., 1996) | El Verde (Ambient, DebRem & Fert) | Hugo 1989 | (Johnson & H. Xing, 2020) | https://soilseries.sc.egov.usda.gov/OSD\_Docs/Z/ZARZAL.html | http://ibtracs.unca.edu/index.php?name=Grid-39174 | http://ibtracs.unca.edu/index.php?name=v04r00-1989254N13340 | (Scatena & Larsen, 1991) |
| (Lodge et al., 1991) | El Verde | Hugo 1989 | (Johnson & H. Xing, 2020) | https://soilseries.sc.egov.usda.gov/OSD\_Docs/Z/ZARZAL.html | http://ibtracs.unca.edu/index.php?name=Grid-39174 | http://ibtracs.unca.edu/index.php?name=v04r00-1989254N13340 | (Scatena & Larsen, 1991) |
| (Ramirez, 2017) | El Verde (Trimming treatment) | CTE 2005 | (Johnson & H. Xing, 2020) | https://soilseries.sc.egov.usda.gov/OSD\_Docs/Z/ZARZAL.html | Same as Hugo 1989 | Same as Hugo 1989 | Same as Hugo 1989 |
| (Ramirez, 2017) | El Verde (Trimming + Debris addition treatment) | CTE 2005 | (Johnson & H. Xing, 2020) | https://soilseries.sc.egov.usda.gov/OSD\_Docs/Z/ZARZAL.html | Same as Hugo 1989 | Same as Hugo 1989 | Same as Hugo 1989 |
| (Ostertag et al., 2003) | Cubuy | Georges 1998 | (Sánchez et al., 2015) | (Sánchez et al., 2015) | http://ibtracs.unca.edu/index.php?name=Grid-39174 | http://ibtracs.unca.edu/index.php?name=v04r00-1998259N10335 | https://www.weather.gov/mob/georges |
| (Ostertag et al., 2003) | Bisley | Georges 1998 | (Johnson & H. Xing, 2020) | (Scatena, 1989) | http://ibtracs.unca.edu/index.php?name=Grid-39174 | http://ibtracs.unca.edu/index.php?name=v04r00-1998259N10335 | https://www.weather.gov/mob/georges |
| (Lodge et al., 1991) | Bisley | Hugo 1989 | (Johnson & H. Xing, 2020) | (Scatena, 1989) | http://ibtracs.unca.edu/index.php?name=Grid-39174 | http://ibtracs.unca.edu/index.php?name=v04r00-1989254N13340 | (Scatena & Larsen, 1991) |
| (Scatena et al., 1996) | Bisley (watersheds 1 & 2) | Hugo 1989 | (Johnson & H. Xing, 2020) | (Scatena, 1989) | http://ibtracs.unca.edu/index.php?name=Grid-39174 | http://ibtracs.unca.edu/index.php?name=v04r00-1989254N13340 | (Scatena & Larsen, 1991) |
| (Covich, 2015) | Bisley (La Prieta) | Hugo 1989 | (Johnson & H. Xing, 2020) | (Scatena, 1989) | http://ibtracs.unca.edu/index.php?name=Grid-39174 | http://ibtracs.unca.edu/index.php?name=v04r00-1989254N13340 | (Scatena & Larsen, 1991) |
| (Liu et al., 2018) | Bisley | Irma 2017 | (Johnson & H. Xing, 2020) | (Scatena, 1989) | http://ibtracs.unca.edu/index.php?name=Grid-39174 | http://ibtracs.unca.edu/index.php?name=v04r00-2017260N12310 | [Keellings & Hernández Ayala, 2019](https://doi.org/10.1029/2019GL082077) |
| (Liu et al., 2018) | Bisley | Maria 2017 | (Johnson & H. Xing, 2020) | (Scatena, 1989) | http://ibtracs.unca.edu/index.php?name=Grid-39174 | http://ibtracs.unca.edu/index.php?name=v04r00-2017260N12310 | [Keellings & Hernández Ayala, 2019](https://doi.org/10.1029/2019GL082077) |
| (Ostertag et al., 2003) | East Peak (Palm) | Georges 1998 | (Frangi & Lugo, 1985) | (Sánchez et al., 2015) | http://ibtracs.unca.edu/index.php?name=Grid-39174 | http://ibtracs.unca.edu/index.php?name=v04r00-1998259N10335 | https://www.weather.gov/mob/georges |
| (Ostertag et al., 2003) | East Peak (Colorado) | Georges 1998 | (Johnson & H. Xing, 2020) | (Sánchez et al., 2015) | http://ibtracs.unca.edu/index.php?name=Grid-39174 | http://ibtracs.unca.edu/index.php?name=v04r00-1998259N10335 | https://www.weather.gov/mob/georges |
| (Ostertag et al., 2003) | East Peak (Cloud) | Georges 1998 | (Frangi & Lugo, 1985) | (Sánchez et al., 2015) | http://ibtracs.unca.edu/index.php?name=Grid-39174 | http://ibtracs.unca.edu/index.php?name=v04r00-1998259N10335 | https://www.weather.gov/mob/georges |
| (Lodge et al., 1991) | East Peak (Cloud) | Hugo 1989 | (Frangi & Lugo, 1985) | (Sánchez et al., 2015) | http://ibtracs.unca.edu/index.php?name=Grid-39174 | http://ibtracs.unca.edu/index.php?name=v04r00-1989254N13340 | (Scatena & Larsen, 1991) |
| (Walker et al., 1996) | East Peak (Cloud) | Hugo 1989 | (Frangi & Lugo, 1985) | (Sánchez et al., 2015) | http://ibtracs.unca.edu/index.php?name=Grid-39174 | http://ibtracs.unca.edu/index.php?name=v04r00-1989254N13340 | (Scatena & Larsen, 1991) |
| (Lugo, 2011) | Utuado | Georges 1998 | (Sánchez et al., 2015) | https://soilseries.sc.egov.usda.gov/OSD\_Docs/M/MUCARA.html | http://ibtracs.unca.edu/index.php?name=Grid-39173 | http://ibtracs.unca.edu/index.php?name=v04r00-1998259N10335 | https://www.weather.gov/mob/georges |
| (Van Bloem et al., 2005) | Guanica | Georges 1998 | (Ariel E. Lugo & Murphy, 1986) | https://soilseries.sc.egov.usda.gov/OSD\_Docs/A/AGUILITA.html | http://ibtracs.unca.edu/index.php?name=Grid-39173 | http://ibtracs.unca.edu/index.php?name=v04r00-1998259N10335 | https://www.weather.gov/mob/georges |
| (Liu et al., 2018) | Guanica | Irma 2017 | (Lugo & Murphy, 1986) | https://soilseries.sc.egov.usda.gov/OSD\_Docs/A/AGUILITA.html | http://ibtracs.unca.edu/index.php?name=Grid-39173 | http://ibtracs.unca.edu/index.php?name=v04r00-2017260N12310 | (Keellings & Hernández Ayala, 2019) |
| (Liu et al., 2018) | Rio Abajo | Irma 2017 | (Sánchez et al., 2015) | (Sánchez et al., 2015) | http://ibtracs.unca.edu/index.php?name=Grid-39173 | http://ibtracs.unca.edu/index.php?name=v04r00-2017260N12310 | (Keellings & Hernández Ayala, 2019) |
| (Liu et al., 2018) | Guayama | Irma 2017 | (Sánchez et al., 2015) | https://www.nrcs.usda.gov/Internet/FSE\_MANUSCRIPTS/puerto\_rico/PR689/0/Humacao.pdf | http://ibtracs.unca.edu/index.php?name=Grid-39173 | http://ibtracs.unca.edu/index.php?name=v04r00-2017260N12310 | (Keellings & Hernández Ayala, 2019) |
| (Liu et al., 2018) | Guanica | Maria 2017 | (Lugo & Murphy, 1986) | https://soilseries.sc.egov.usda.gov/OSD\_Docs/A/AGUILITA.html | http://ibtracs.unca.edu/index.php?name=Grid-39173 | http://ibtracs.unca.edu/index.php?name=v04r00-2017260N12310 | (Keellings & Hernández Ayala, 2019) |
| (Liu et al., 2018) | Rio Abajo | Maria 2017 | (Sánchez et al., 2015) | (Sánchez et al., 2015) | http://ibtracs.unca.edu/index.php?name=Grid-39173 | http://ibtracs.unca.edu/index.php?name=v04r00-2017260N12310 | (Keellings & Hernández Ayala, 2019) |
| (Liu et al., 2018) | Guayama | Maria 2017 | (Sánchez et al., 2015) | https://www.nrcs.usda.gov/Internet/FSE\_MANUSCRIPTS/puerto\_rico/PR689/0/Humacao.pdf | http://ibtracs.unca.edu/index.php?name=Grid-39173 | http://ibtracs.unca.edu/index.php?name=v04r00-2017260N12310 | (Keellings & Hernández Ayala, 2019) |
| (Beard et al., 2005) | Bisley-El Verde | Bertha 1996 | (Johnson & H. Xing, 2020) | (Scatena, 1989) | http://ibtracs.unca.edu/index.php?name=Grid-39174 | http://ibtracs.unca.edu/index.php?name=v04r00-1996187N10326 | https://www.wpc.ncep.noaa.gov/tropical/rain/bertha1996.html |
| (Imbert & Portecop, 2008) | Grande-Terre | Hugo 1989 | Imbert, personal communication | (Imbert & Portecop, 2008) | http://ibtracs.unca.edu/index.php?name=Grid-38458 | http://ibtracs.unca.edu/index.php?name=v04r00-1989254N13340 | (Scatena & Larsen, 1991) |
| (Herbert et al., 1999) | Kokee | Iniki 1992 | (Herbert & Fownes, 1995) | (Herbert et al., 1999) | http://ibtracs.unca.edu/index.php?name=Grid-40520 | http://ibtracs.unca.edu/index.php?name=v04r00-1992249N12229 | https://web.archive.org/web/20141223194438/http://coast.noaa.gov/hes/docs/postStorm/H\_INIKI\_ASSESSMENT\_REVIEW\_HES\_UTILIZATION\_INFO\_DISSEMINATION.pdf |
| (Harrington et al., 1997) | Makaha 1 | Iniki 1992 | (Harrington et al., 1995) | (Harrington et al., 1995) and U.S. NRCS web soil survey | http://ibtracs.unca.edu/index.php?name=Grid-40520 | http://ibtracs.unca.edu/index.php?name=v04r00-1992249N12229 | https://web.archive.org/web/20141223194438/http://coast.noaa.gov/hes/docs/postStorm/H\_INIKI\_ASSESSMENT\_REVIEW\_HES\_UTILIZATION\_INFO\_DISSEMINATION.pdf |
| (Harrington et al., 1997) | Milolii | Iniki 1992 | (Harrington et al., 1995) | (Harrington et al., 1995) and U.S. NRCS web soil survey | http://ibtracs.unca.edu/index.php?name=Grid-40520 | http://ibtracs.unca.edu/index.php?name=v04r00-1992249N12229 | https://web.archive.org/web/20141223194438/http://coast.noaa.gov/hes/docs/postStorm/H\_INIKI\_ASSESSMENT\_REVIEW\_HES\_UTILIZATION\_INFO\_DISSEMINATION.pdf |
| (Harrington et al., 1997) | Kumuwela | Iniki 1992 | (Harrington et al., 1995) | (Harrington et al., 1995) and U.S. NRCS web soil survey | http://ibtracs.unca.edu/index.php?name=Grid-40520 | http://ibtracs.unca.edu/index.php?name=v04r00-1992249N12229 | https://web.archive.org/web/20141223194438/http://coast.noaa.gov/hes/docs/postStorm/H\_INIKI\_ASSESSMENT\_REVIEW\_HES\_UTILIZATION\_INFO\_DISSEMINATION.pdf |
| (Harrington et al., 1997) | Halemanu | Iniki 1992 | (Harrington et al., 1995) | (Harrington et al., 1995) and U.S. NRCS web soil survey | http://ibtracs.unca.edu/index.php?name=Grid-40520 | http://ibtracs.unca.edu/index.php?name=v04r00-1992249N12229 | https://web.archive.org/web/20141223194438/http://coast.noaa.gov/hes/docs/postStorm/H\_INIKI\_ASSESSMENT\_REVIEW\_HES\_UTILIZATION\_INFO\_DISSEMINATION.pdf |
| (Whigham et al., 1991) | San Felipe | Gilbert 1988 | (Campo & Vazquez-Yanes, 2004) | (Campo & Vazquez-Yanes, 2004) | http://ibtracs.unca.edu/index.php?name=Grid-39873 | http://ibtracs.unca.edu/index.php?name=v04r00-1988253N12306 | https://www.wpc.ncep.noaa.gov/tropical/rain/gilbert1988.html |
| (Martínez-Yrízar et al., 2018) | Chamela-Cuixmala | Jova 2011 | (Martínez-Yrízar et al., 2018) | (Martínez-Yrízar et al., 2018) | <http://ibtracs.unca.edu/index.php?name=Grid-39495> | http://ibtracs.unca.edu/index.php?name=v04r00-2011279N10257 | (Parker et al., 2018) |
| (Martínez-Yrízar et al., 2018) | Chamela-Cuixmala | Patricia 2015 | (Martínez-Yrízar et al., 2018) | (Martínez-Yrízar et al., 2018) | http://ibtracs.unca.edu/index.php?name=Grid-39495 | http://ibtracs.unca.edu/index.php?name=v04r00-2015293N13266 | (Parker et al., 2018) |
| (Wang et al., 2013) | Lienhuachi | Kalmaegi 2008 | (Zhang et al., 2005) | (Chang et al., 2016) | http://ibtracs.unca.edu/index.php?name=Grid-40800 | http://ibtracs.unca.edu/index.php?name=v04r00-2008193N20126 | (Wang et al., 2013) |
| (Wang et al., 2013) | Lienhuachi | Fungwong  2008 | (Zhang et al., 2005) | (Chang et al., 2016) | http://ibtracs.unca.edu/index.php?name=Grid-40800 | http://ibtracs.unca.edu/index.php?name=v04r00-2008206N22133 | (Wang et al., 2013) |
| (Wang et al., 2013) | Lienhuachi | Sinlaku  2008 | (Zhang et al., 2005) | (Chang et al., 2016) | http://ibtracs.unca.edu/index.php?name=Grid-40800 | http://ibtracs.unca.edu/index.php?name=v04r00-2008252N16128 | (Wang et al., 2013) |
| (Wang et al., 2013) | Lienhuachi | Jangmi | (Zhang et al., 2005) | (Chang et al., 2016) | http://ibtracs.unca.edu/index.php?name=Grid-40800 | http://ibtracs.unca.edu/index.php?name=v04r00-2008268N12140 | (Wang et al., 2013) |
| (Liao et al., 2006) | Kengting III | Mindulle 2004 | (Liao et al., 2006) | (Huang et al., 2017) | http://ibtracs.unca.edu/index.php?name=Grid-40440 | http://ibtracs.unca.edu/index.php?name=v04r00-2004174N14146 | (Liao et al., 2006) |
| (Liao et al., 2006) | Kengting IV | Mindulle 2004 | (Liao et al., 2006) | (Huang et al., 2017) | http://ibtracs.unca.edu/index.php?name=Grid-40440 | http://ibtracs.unca.edu/index.php?name=v04r00-2004174N14146 | (Liao et al., 2006) |
| (Liao et al., 2006) | Kengting III | Haima  2004 | (Liao et al., 2006) | (Huang et al., 2017) | http://ibtracs.unca.edu/index.php?name=Grid-40440 | http://ibtracs.unca.edu/index.php?name=v04r00-2004255N23120 | (Liao et al., 2006) |
| (Liao et al., 2006) | Kengting IV | Haima  2004 | (Liao et al., 2006) | (Huang et al., 2017) | http://ibtracs.unca.edu/index.php?name=Grid-40440 | http://ibtracs.unca.edu/index.php?name=v04r00-2004255N23120 | (Liao et al., 2006) |
| (Liao et al., 2006) | Kengting III | Nanmadol 2004 | (Liao et al., 2006) | (Huang et al., 2017) | http://ibtracs.unca.edu/index.php?name=Grid-40440 | http://ibtracs.unca.edu/index.php?name=v04r00-2004333N06154 | (Liao et al., 2006) |
| (Liao et al., 2006) | Kengting IV | Nanmadol 2004 | (Liao et al., 2006) | (Huang et al., 2017) | http://ibtracs.unca.edu/index.php?name=Grid-40440 | http://ibtracs.unca.edu/index.php?name=v04r00-2004333N06154 | (Liao et al., 2006) |

*Note:* c Three typhoons (i.e., cyclone disturbances in Taiwan) occurred during 2004, namely Mindulle, Haima and Nanmadol, on 28 June–3 July, 11–13 September and 3–4 December, respectively; the three typhoons brought strong storms with heavy rainfall (>200 mm typhoon-1).

**References**

Beard, K. H., Vogt, K. A., Vogt, D. J., Scatena, F. N., Covich, A. P., Sigurdardottir, R., Siccama, T. G., & Crowl, T. A. (2005). STRUCTURAL AND FUNCTIONAL RESPONSES OF A SUBTROPICAL FOREST TO 10 YEARS OF HURRICANES AND DROUGHTS. *Ecological Monographs*, *75*(3), 345–361. https://doi.org/10.1890/04-1114

Benson, L. J., & Pearson, R. G. (1993). Litter inputs to a tropical Australian rainforest stream. *Australian Journal of Ecology*, *18*(4), 377–383. https://doi.org/10.1111/j.1442-9993.1993.tb00465.x

Boose, E. R., Serrano, M. I., & Foster, D. R. (2004). Landscape and regional impacts of hurricanes in Puerto Rico. *Ecological Monographs*, *74*(2), 335–352. https://doi.org/10.1890/02-4057

Brasell, H. M., Unwin, G. L., & Stocker, G. C. (1980). The Quantity, Temporal Distribution and Mineral-Element Content of Litterfall in Two Forest Types at Two Sites in Tropical Australia. *Journal of Ecology*, *68*(1), 123–139. JSTOR. https://doi.org/10.2307/2259247

Buol, S. W., Southard, R. J., Graham, R. C., & McDaniel, P. A. (2011). *Soil Genesis and Classification: Buol/Soil Genesis and Classification*. Wiley-Blackwell. https://doi.org/10.1002/9780470960622

Campo, J., & Vazquez-Yanes, C. (2004). Effects of Nutrient Limitation on Aboveground Carbon Dynamics during Tropical Dry Forest Regeneration in Yucat�n, Mexico. *Ecosystems*, *7*(3). https://doi.org/10.1007/s10021-003-0249-2

Chang, E.-H., Chen, T.-H., Tian, G., Hsu, C.-K., & Chiu, C.-Y. (2016). Effect of 40 and 80 Years of Conifer Regrowth on Soil Microbial Activities and Community Structure in Subtropical Low Mountain Forests. *Forests*, *7*(12), 244. https://doi.org/10.3390/f7100244

Congdon, R. A., & Herbohn, J. L. (1993). Ecosystem Dynamics of Disturbed and Undisturbed Sites in North Queensland Wet Tropical Rain Forest. I. Floristic Composition, Climate and Soil Chemistry. *Journal of Tropical Ecology*, *9*(3), 349–363. JSTOR. http://www.jstor.org/stable/2559535

Covich, A. (2015). *Litterfall along topographic gradients at lower Bisley* [Data set]. Environmental Data Initiative. https://doi.org/10.6073/PASTA/F28B64F01A2F74EEAEF2A6395D6B1EEF

Duxbury, J., Smith, M., & Doran, J. (1989). Soil organic matter as a source and a sink of plant nutrients. *Dynamics of Soil Organic Matter in Tropical Ecosystems*. https://ci.nii.ac.jp/naid/10020174322/en/

Frangi, J. L., & Lugo, A. E. (1985). Ecosystem Dynamics of a Subtropical Floodplain Forest. *Ecological Monographs*, *55*(3), 351–369. JSTOR. https://doi.org/10.2307/1942582

Gleason, S. M., Williams, L. J., Read, J., Metcalfe, D. J., & Baker, P. J. (2008). Cyclone Effects on the Structure and Production of a Tropical Upland Rainforest: Implications for Life-History Tradeoffs. *Ecosystems*, *11*(8), 1277–1290. https://doi.org/10.1007/s10021-008-9192-6

Gleason, S., Read, J., Ares, A., & Metcalfe, D. (2009). Species-soil associations, disturbance, and nutrient cycling in an Australian tropical rainforest. *Oecologia*, *162*, 1047–1058. https://doi.org/10.1007/s00442-009-1527-2

Hall, J., Muscarella, R., Quebbeman, A., Arellano, G., Thompson, J., Zimmerman, J. K., & Uriarte, M. (2020). Hurricane-Induced Rainfall is a Stronger Predictor of Tropical Forest Damage in Puerto Rico Than Maximum Wind Speeds. *Scientific Reports*, *10*(1), 4318. https://doi.org/10.1038/s41598-020-61164-2

Harrington, R. A., Fownes, J. H., Frederick C. Meinzer, & Scowcroft, P. G. (1995). Forest Growth along a Rainfall Gradient in Hawaii: Acacia koa Stand Structure, Productivity, Foliar Nutrients, and Water- and Nutrient-Use Efficiencies. *Oecologia*, *102*(3), 277–284. JSTOR. http://www.jstor.org/stable/4220960

Harrington, R. A., Fownes, J. H., Scowcroft, P. G., & Vann, C. S. (1997). Impact of Hurricane Iniki on native Hawaiian Acacia koa forests: Damage and two-year recovery. *Journal of Tropical Ecology*, *13*(4), 539–558. Cambridge Core. https://doi.org/10.1017/S0266467400010701

Herbert, D. A., & Fownes, J. H. (1995). Phosphorus limitation of forest leaf area and net primary production on a highly weathered soil. *Biogeochemistry*, *29*(3), 223–235. https://doi.org/10.1007/BF02186049

Herbert, D. A., Fownes, J. H., & Vitousek, P. M. (1999). HURRICANE DAMAGE TO A HAWAIIAN FOREST: NUTRIENT SUPPLY RATE AFFECTS RESISTANCE AND RESILIENCE. *Ecology*, *80*(3), 908–920. https://doi.org/10.1890/0012-9658(1999)080[0908:HDTAHF]2.0.CO;2

Herbohn, J. L., & Congdon, R. A. (1993). Ecosystem Dynamics at Disturbed and Undisturbed Sites in North Queensland Wet Tropical Rain Forest. II. Litterfall. *Journal of Tropical Ecology*, *9*(3), 365–380. JSTOR. http://www.jstor.org/stable/2559537

Huang, W.-S., Jien, S.-H., Huang, S.-T., Tsai, H., & Hseu, Z.-Y. (2017). Pedogenesis of red soils overlaid coral reef terraces in the Southern Taiwan. *Environmental and Climatic Changes Inferred from Sedimentary Records on Asian Shelf Margins: Part II*, *441*, 62–76. https://doi.org/10.1016/j.quaint.2016.09.064

Imbert, D., & Portecop, J. (2008). Hurricane disturbance and forest resilience: Assessing structural vs. Functional changes in a Caribbean dry forest. *Forest Ecology and Management*, *255*(8), 3494–3501. https://doi.org/10.1016/j.foreco.2008.02.030

Johnson, A., & H. Xing. (2020). *LCZO -- Soil Survey—Northeastern Puerto Rico and the Luquillo Mountain—(2011-2012)* [Soil Survey]. HydroShare. http://www.hydroshare.org/resource/9211abc0a4fe4611a7c72ac31c35840c

Keellings, D., & Hernández Ayala, J. J. (2019). Extreme Rainfall Associated With Hurricane Maria Over Puerto Rico and Its Connections to Climate Variability and Change. *Geophysical Research Letters*, *46*(5), 2964–2973. https://doi.org/10.1029/2019GL082077

Knapp, K. R., Kruk, M. C., Levinson, D. H., Diamond, H. J., & Neumann, C. J. (2010). The International Best Track Archive for Climate Stewardship (IBTrACS): Unifying Tropical Cyclone Data. *Bulletin of the American Meteorological Society*, *91*(3), 363–376. https://doi.org/10.1175/2009BAMS2755.1

Liao, J.-H., Wang, H.-H., Tsai, C.-C., & Hseu, Z.-Y. (2006). Litter production, decomposition and nutrient return of uplifted coral reef tropical forest. *Forest Ecology and Management*, *235*(1), 174–185. https://doi.org/10.1016/j.foreco.2006.08.010

Liu, X., Zeng, X., Zou, X., González, G., Wang, C., & Yang, S. (2018). Litterfall Production Prior to and during Hurricanes Irma and Maria in Four Puerto Rican Forests. *Forests*, *9*(6), 367. https://doi.org/10.3390/f9060367

Lodge, D. J., Scatena, F. N., Asbury, C. E., & Sanchez, M. J. (1991). Fine Litterfall and Related Nutrient Inputs Resulting From Hurricane Hugo in Subtropical Wet and Lower Montane Rain Forests of Puerto Rico. *Biotropica*, *23*(4), 336–342. JSTOR. https://doi.org/10.2307/2388249

Lugo, A. E. (2011). Hurricane Georges Accelerated Litterfall Fluxes of a 26 yr-old Novel Secondary Forest in Puerto Rico. In C. M. D. Cristóbal (Ed.), & Noemí Méndez ED1 - Anthony Lupo (Trans.), *Recent Hurricane Research* (p. Ch. 28). IntechOpen. https://doi.org/10.5772/14385

Lugo, A. E., & Murphy, P. G. (1986). Nutrient Dynamics of a Puerto Rican Subtropical Dry Forest. *Journal of Tropical Ecology*, *2*(1), 55–72. JSTOR. http://www.jstor.org/stable/2559773

Martínez-Yrízar, A., Jaramillo, V. J., Maass, M., Búrquez, A., Parker, G., Álvarez-Yépiz, J. C., Araiza, S., Verduzco, A., & Sarukhán, J. (2018). Resilience of tropical dry forest productivity to two hurricanes of different intensity in western Mexico. *Resilience of Tropical Dry Forests to Extreme Disturbance Events*, *426*, 53–60. https://doi.org/10.1016/j.foreco.2018.02.024

Ostertag, R., Scatena, F. N., & Silver, W. L. (2003). Forest Floor Decomposition Following Hurricane Litter Inputs in Several Puerto Rican Forests. *Ecosystems*, *6*(3), 261–273. JSTOR. http://www.jstor.org/stable/3658892

Ostertag, R., Silver, W. L., & Lugo, A. E. (2005). Factors Affecting Mortality and Resistance to Damage Following Hurricanes in a Rehabilitated Subtropical Moist Forest1. *Biotropica*, *37*(1), 16–24. https://doi.org/10.1111/j.1744-7429.2005.04052.x

Parker, G., Martínez-Yrízar, A., Álvarez-Yépiz, J. C., Maass, M., & Araiza, S. (2018). Effects of hurricane disturbance on a tropical dry forest canopy in western Mexico. *Resilience of Tropical Dry Forests to Extreme Disturbance Events*, *426*, 39–52. https://doi.org/10.1016/j.foreco.2017.11.037

Porder, S., & Ramachandran, S. (2013). The phosphorus concentration of common rocks—A potential driver of ecosystem P status. *Plant and Soil*, *367*, 41–55. https://doi.org/10.1007/s11104-012-1490-2

Ramirez, A. (2017). *Canopy Trimming Experiment (CTE) Litterfall* [Data set]. Environmental Data Initiative. https://doi.org/10.6073/PASTA/D0B205153E104CC5B411D8286A1CA037

Rohatgi, A. (2015). *WebPlotDigitizer* (3.9) [Computer software]. https://automeris.io/WebPlotDigitizer/

Sánchez, M. J., Lopez, E., & Lugo, A. E. (2015). *Chemical and physical analyses of selected plants and soils of Puerto Rico (1981–2000).* (p. 85). Gen. Tech. Rep. GTR-IITF-45. Rio Piedras, PR: U.S. Department of Agriculture, Forest Service, International Institute of Tropical Forestry. https://data.fs.usda.gov/research/pubs/iitf/IITF\_GTR\_45\_Expanded.pdf

Scatena, F. N. (1989). *An Introduction to the Physiography and History of the Bisley Experimental Watersheds in the Luquillo Mountains of Puerto Rico* (SO-GTR-72; p. SO-GTR-72). U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. https://doi.org/10.2737/SO-GTR-72

Scatena, F. N., & Larsen, M. C. (1991). Physical Aspects of Hurricane Hugo in Puerto Rico. *Biotropica*, *23*(4), 317–323. JSTOR. https://doi.org/10.2307/2388247

Scatena, F. N., Moya, S., Estrada, C., & Chinea, J. D. (1996). The First Five Years in the Reorganization of Aboveground Biomass and Nutrient Use Following Hurricane Hugo in the Bisley Experimental Watersheds, Luquillo Experimental Forest, Puerto Rico. *Biotropica*, *28*(4), 424–440. JSTOR. https://doi.org/10.2307/2389086

Soil Survey Staff. (1999). *Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition.* (Natural Resources Conservation Service. U.S. Department of Agriculture Handbook 436). https://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/survey/class/taxonomy/

Spain, A. (1990). Influence of environmental conditions and some soil chemical properties on the carbon and nitrogen contents of some tropical Australian rainforest soils. *Soil Research*, *28*(6), 825–839. https://doi.org/10.1071/SR9900825

Van Bloem, S. J., Murphy, P. G., Lugo, A. E., Ostertag, R., Costa, M. R., Bernard, I. R., Colon, S. M., & Mora, M. C. (2005). The Influence of Hurricane Winds on Caribbean Dry Forest Structure and Nutrient Pools1. *Biotropica*, *37*(4), 571–583. https://doi.org/10.1111/j.1744-7429.2005.00074.x

Vitousek, P., Chadwick, O., Matson, P., Allison, S., Derry, L., Kettley, L., Luers, A., Mecking, E., Monastra, V., & Porder, S. (2003). Erosion and the Rejuvenation of Weathering-derived Nutrient Supply in an Old Tropical Landscape. *Ecosystems*, *6*(8), 762–772. https://doi.org/10.1007/s10021-003-0199-8

Walker, L. R., Zimmerman, J. K., Lodge, D. J., & Guzman-Grajales, S. (1996). An Altitudinal Comparison of Growth and Species Composition in Hurricane- Damaged Forests in Puerto Rico. *Journal of Ecology*, *84*(6), 877–889. JSTOR. https://doi.org/10.2307/2960559

Wang, H.-C., Wang, S.-F., Lin, K.-C., Lee Shaner, P.-J., & Lin, T.-C. (2013). Litterfall and Element Fluxes in a Natural Hardwood Forest and a Chinese-fir Plantation Experiencing Frequent Typhoon Disturbance in Central Taiwan. *Biotropica*, *45*(5), 541–548. https://doi.org/10.1111/btp.12048

Whigham, D. F., Olmsted, I., Cano, E. C., & Harmon, M. E. (1991). The Impact of Hurricane Gilbert on Trees, Litterfall, and Woody Debris in a Dry Tropical Forest in the Northeastern Yucatan Peninsula. *Biotropica*, *23*(4), 434. https://doi.org/10.2307/2388263

Zhang, C., Tian, H., Liu, J., Wang, S., Liu, M., Pan, S., & Shi, X. (2005). Pools and distributions of soil phosphorus in China: POOLS AND DISTRIBUTIONS OF SOIL PHOSPHORUS. *Global Biogeochemical Cycles*, *19*(1). https://doi.org/10.1029/2004GB002296

Zimmerman, J. K., Pulliam, W. M., Lodge, D. J., Quiñones-Orfila, V., Fetcher, N., Guzmán-Grajales, S., Parrotta, J. A., Asbury, C. E., Walker, L. R., & Waide, R. B. (1995). Nitrogen Immobilization by Decomposing Woody Debris and the Recovery of Tropical Wet Forest from Hurricane Damage. *Oikos*, *72*(3), 314–322. JSTOR. https://doi.org/10.2307/3546116