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NPP Tropical Forest: John Crow Ridge, Jamaica, 1974-1978, R1

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Revision date: September 6, 2013

NPP Tropical Forest: John Crow Ridge, Jamaica, 1974-1978

Summary:

This data set contains five NPP data files and three climate data files (ASCII .txt format). There is one NPP file for each of the five sub-types of upper montane tropical forest located along John Crow Ridge in the Blue Mountains of Jamaica. Biomass, productivity, tree mortality, standing crop of litter, LAI, and nutrient content of leaf fall were measured from 1974 to 1978. Long-term climate data are available from Cinchona Botanic Gardens, approximately 3 km south of the John Crow Ridge study area and at similar elevation.

The John Crow Ridge study areas (18.08 N 76.65 W) consist of 8 to 10 contiguous 10 m x 10 m permanent plots. The forests are of low stature and appear to be completely undisturbed. The forest floor at one sub-site (Mor Ridge) was overlain by a 30-50 cm layer of mor humus with a high C/N ratio.

ANPP was estimated to be between 654-997 g/m²/year (sum of litterfall and trunk/branch increment), or 854-1,057 g/m²/year (including tree mortality). These figures are lower than for lowland tropical forests with greater leaf turnover and reflect the relatively low stature of the upper montane forest plots. Above-ground biomass was estimated by both destructive methods and nondestructive regression analysis. Values ranged from 23,000 to 34,000 g/m². Below-ground biomass (5,370 g/m²) was determined for one site by harvesting roots to a depth of 50 cm. LAI for trees plus understory, where measured, was 5.5-5.7 m²/m².

Revision Notes: Only the documentation for this data set has been modified. The data files have been checked for accuracy and are identical to those originally published in 1999.



Figure 1. Tropical montane forest near Morce's Gap, close to the John Crow Ridge study site, Jamaica - as it appeared in the early 20th century. In the center is the tree-fern *Cyathea pubescens*; in the foreground *Diplazium centridifolium* and *Diplazium altissimum*. (Photograph taken about 1912 by Forrest Shreve. From Shreve, F., 1914. *A Montane Rain Forest*. Reproduced by kind permission of the Carnegie Institution of Washington). (JHN-1.jpg)

Additional Documentation:

The Net Primary Productivity (NPP) data collection contains field measurements of biomass, estimated NPP, and climate data for terrestrial grassland, tropical forest, boreal forest, and tundra sites worldwide. Data were compiled from the published literature for intensively studied and well-documented individual field sites and from a number of previously compiled multi-site, multi-biome data sets of georeferenced NPP estimates. The principal compilation effort (Olson et al., 2001) was sponsored by the NASA Terrestrial Ecology Program. For more information, please visit the NPP web site at http://daac.ornl.gov/NPP/npp_home.html.

Data Citation:

Cite this data set as follows:

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1. Data Set Overview:

Project: Net Primary Productivity (NPP)

The above-ground net primary productivity (ANPP) measurements presented here are the sum of total litterfall and wood production for five contrasting upper montane tropical forests located along John Crow Ridge in the Blue Mountains of Jamaica. Mortality was also estimated for some of the sub-sites.

The John Crow Ridge study area (18.08 N 76.65 W) is located on the Grand Ridge of the western Blue Mountains, between Morce's Gap and John Crow Peak. Each sub-site consists of 8 or 10 contiguous permanent plots, each 10 m x 10 m. The forest is of low stature, and appeared to be

completely undisturbed at the commencement of the study. The forest floor at one sub-site (Mor Ridge) was overlain by a 30-50 cm layer of mor humus with a high C/N ratio.

Biomass and productivity were determined for the five forests from 1974 to 1978. These measurements formed part of a study of nutrient cycling carried out in collaboration with the University of the West Indies. More recent studies have covered regrowth after hurricane damage and regeneration on landslides.

ANPP was estimated to be in the range of 654 (Mull Ridge) to 997 g/m²/year (Gap Forest) based on the sum of litterfall and trunk/branch increment. When tree mortality is added, ANPP ranges from 854 (Mull Ridge) to 1,057 g/m²/year (Gap Forest). These figures are lower than for lowland tropical forests, with a greater proportion accounted for by leaf turnover. This is reflected by the relatively low stature of the upper montane forest.

Estimates of ANPP, BNPP, and TNPP reported in Scurlock and Olson (2012), Olson et al. (2012a, b), and Clark et al. (2001a, b) differ from the values reported herein because they are derived from different calculation methods (Table 1).

Table 1. ANPP, BNPP, and TNPP values reported by various published data sources

File Name or Description	Data Source(s)	Sub-Site	ANPP	BNPP	TNPP
			gC/m ² /year		
jhn1_npp.txt	Tanner (1980) ¹	jhn1 jhn Morridge	345	NA	NA
jhn2_npp.txt		jhn2 jhn Mullridge	327	NA	NA
			340	NA	NA
jhn3_npp.txt		jhn3 jhn Wetslope	378	NA	NA
jhn4_npp.txt		jhn4 jhn Gap	499	NA	NA
jhn5_npp.txt	jhn5 jhn WDMullridge (Well-developed Mull Ridge) ²	265	NA	NA	
NPP_Multibiome_EnvReview_Table_A1_R1.csv	Scurlock and Olson (2012) based on Tanner (1980) ³	jhn (average of the three sub-sites Mull Ridge, Wet Slope & Gap Forest)	494	NA	NA
ods_xls.csv	Esser (1998) based on Tanner (1980) ¹	1285 (Mor Ridge)	345	NA	NA
		1284 (Mull Ridge)	325	NA	NA
		1282 (Wet Slope)	380	NA	NA
		1286 (Gap Forest)	495	NA	NA
		1283 (Mull Ridge)	340	NA	NA
GPPDI_ClassB_NPP_2363_R2.csv	Olson et al. (2012a) from Esser (1998) based on Tanner (1980) ³	Class B 117 (MI 206) (Mor Ridge)	330	NA	NA
		Class B 117 (MI 205) (Mull Ridge)	310	NA	NA
		Class B 117 (MI 204) (Wet Slope)	360	NA	NA
		Class B 117 (MI 207) (Gap Forest)	470	NA	NA
GPPDI_ClassB_NPP_2363_R2.csv	Olson et al. (2012a) based on ORNL	Class B 117 (MI 209) (Mor Ridge)	270	190	470
		Class B 117 (MI 208) (Mull Ridge)	240	170	410
		Class B 117 (MI 210) (Gap Forest)	270	190	450
		Olson et al. (2012a) based on Tanner (1980)	Class B 117 (MI 211) (average of the three sub-sites Mull Ridge, Wet Slope & Gap Forest)	450	NA
EMDI_ClassB_NPP_933_v2.csv	Olson et al. (2012b) based on Esser (1998) ³	Class B 117 (average of the three sub-sites Mull Ridge, Wet Slope & Gap Forest)	460	NA	NA
Table 1 in Clark et al. (2001a)	Clark et al. (2001a) ⁴	Blue Mtn. Mor Ridge	580	120-690 (av 405)	690-1,270 (av 980)
		Blue Mtn. Mull Ridge	500	100-600 (av 350)	600-1,100 (av 850)
				100-600	600-1,100

		Blue Mtn. Wet Slope	500	(av 350)	(av 850)
		Blue Mtn. Gap Forest	560	110-670 (av 390)	670-1,240 (av 955)
Appendix A in Clark et al. (2001a)	Clark et al. (2001a) based on Tanner (1980) ⁵	Blue Mtn. #2 (Mor Ridge)	350	NA	NA
		Blue Mtn. #3 (Mull Ridge)	330	NA	NA
		Blue Mtn. #4 (Wet Slope)	280	NA	NA
		Blue Mtn. #1 (Gap Forest)	490	NA	NA
Appendix A in Clark et al. (2001a)	Clark et al. (2001a) ⁴	Blue Mtn. #2 (Mor Ridge)	NA	NA	690-1,270 (av 980)
		Blue Mtn. #3 (Mull Ridge)	NA	NA	600-1,100 (av 850)
		Blue Mtn. #4 (Wet Slope)	NA	NA	600-1,100 (av 850)
		Blue Mtn. #1 (Gap Forest)	NA	NA	670-1,240 (av 955)
tropforNPP.csv	Clark et al. (2001b) ⁶ based on Tanner (1977; 1980a, b; 1985)	Jamaica - Blue Mtn. Mor Ridge	356	NA	NA
		Jamaica - Blue Mtn. Mull Ridge	334	NA	NA
		Jamaica - Blue Mtn. Wet Slope	378	NA	NA
		Jamaica - Blue Mtn. Gap Forest	499	NA	NA

Notes: NA = Not available. MI = Measurement ID number. The differences in NPP values reported in this table are mainly due to differences in calculation methods, as explained in these notes. Please consult original references for details. Revised data sets (R1, R2, etc) are accompanied by ORNL DAAC Data Set Change Information files. Please see the corresponding documentation for reasons why the data values were revised. ¹For this table, NPP data from the original data source were converted from grams of dry weight per meter square per year to grams of carbon per meter square per year using a conversion factor of 0.5. The ANPP estimate is based on field measurement of total litterfall accumulation + trunk and branch biomass increment, giving a minimum estimate of NPP. ²Based on litterfall accumulation only. ³Based on field measurement of total litterfall accumulation + trunk and branch biomass increment + mortality. Note that ANPP estimates reported in the individual site data files do not include mortality. ⁴Clark et al. (2001a) used a different approach to calculate net primary production values. ANPP was calculated by summing reported above-ground biomass increment + reported fine litterfall + estimated losses to consumers + estimated VOC emissions. BNPP was calculated by summing 0.2 x estimated ANPP for a low BNPP estimate + 1.2 x estimated ANPP for a high BNPP estimate. TNPP was calculated as the range between the low and high values of ANPP + BNPP. Average BNPP and TNPP estimates were also calculated. See Clark et al. (2001a) for a discussion of calculation methods, including how unmeasured components of ANPP were estimated and the basis for setting bounds on BNPP. ⁵Clark et al. (2001a) converted NPP data from the original data source from grams of dry weight per meter square per year to grams of carbon per meter square per year using a conversion factor of 0.475. ⁶The Clark et al. (2001b) ANPP estimate is based on field measurement of total litterfall accumulation + trunk and branch biomass increment. In this table, NPP data from Clark et al. (2001b) were converted from megagrams of dry weight per hectare per year to grams of carbon per meter square per year using a carbon conversion factor of 0.5.

2. Data Description:

Spatial Coverage

Site: John Crow Ridge, Jamaica

Site Boundaries: (All latitude and longitude given in decimal degrees)

Site (Region)	Westernmost Longitude	Easternmost Longitude	Northernmost Latitude	Southernmost Latitude	Elevation (m)
John Crow Ridge, Jamaica	-76.65	-76.65	18.08	18.08	1,530-1,615

Site Information

The study area consists of five sub-sites located at c. 1,530-1,615 m elevation on a ridge between John Crow Peak and Morce's Gap in the Blue Mountains of Jamaica (Figure 2). The five sub-sites represent the five forest types listed in Table 2. The whole forest along the ridge studied was either completely undisturbed or had not been disturbed for many years. The trees in all the forest types are relatively small; there is a gradation in

canopy height from 5-7 m in the Mor Ridge forest to 8-13 m in the Mull Ridge and Wet Slope forests, and to 12-16 m in the Gap Forest.

The Jamaican forest types are different from lowland and well-developed lower montane rainforests in that the scale of the regeneration pattern in the forests is smaller. The Mor Ridge, Mull Ridge and Wet Slope forests are typical of upper montane rainforests in not having tree-falls that cause large gaps and give rise to a large-scale mosaic in the forest. When trees die, they either fall but cause little damage because they are small or of similar size to surrounding trees and not linked to other trees by lianas, or the trees disintegrate over a number of years in situ. The Gap Forest is different in that it does have a more noticeable regeneration pattern due to larger trees which cause gaps when they fall. In this respect, the Gap Forest is more like a typical lower montane rainforest.

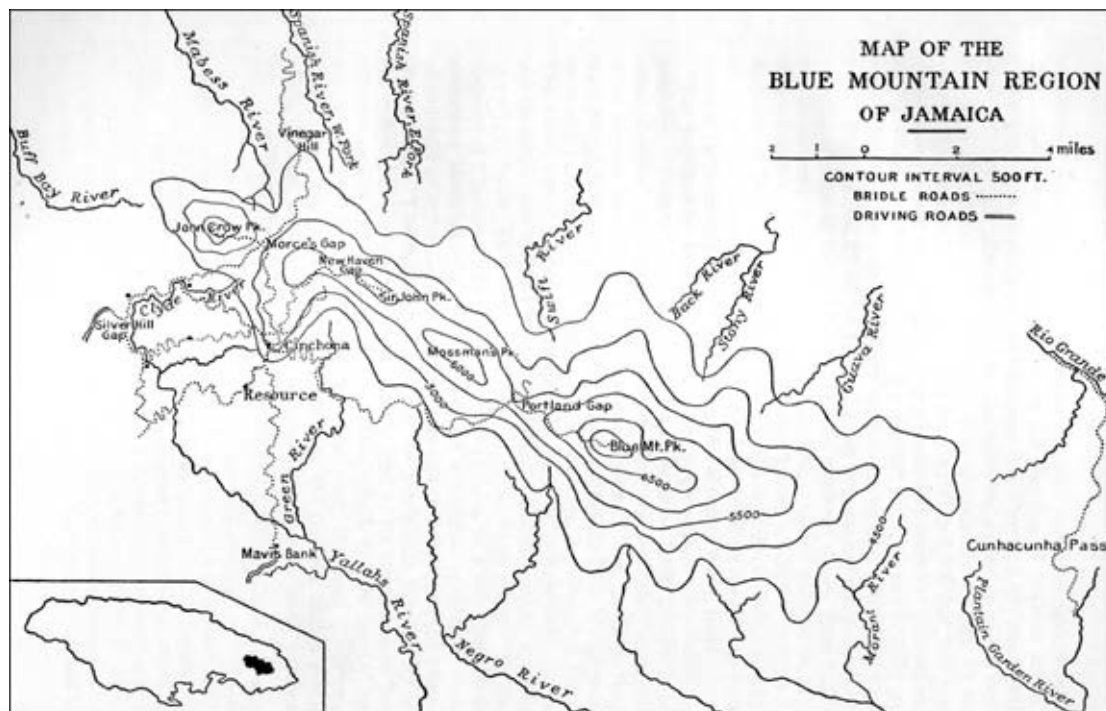


Figure 2. Map showing location of the John Crow Ridge tropical forest study site, at the western end of the Blue Mountains, between John Crow Peak and Morce's Gap. (Map from Shreve, F., 1914. A Montane Rain Forest. Reproduced by kind permission of the Carnegie Institution of Washington). (JHN-2.jpg)

Table 2. John Crow Ridge Sub-Sites

Sub-Sites	Elevation (m)	Mean Annual Precipitation (mm)	Forest Association
Mor Ridge	1,615	2,230	<i>Chaetocarpus globosus</i> - <i>Clusia</i> cf. <i>havetioides</i> - <i>Lyonia</i> cf. <i>octandra</i> association
Mull Ridge	1,600	2,230	<i>Dendropanax pendulus</i> - <i>Hedyosmum arborescens</i> - <i>Podocarpus urbanii</i> association
Wet Slope	1,555-1,590	2,230	<i>Dendropanax pendulus</i> - <i>Hedyosmum arborescens</i> - <i>Podocarpus urbanii</i> association
Gap Forest	1,590	2,230	<i>Cyathea pubescens</i> - <i>Meriania purpurea</i> - <i>Solanum punctulatum</i> association
Well-developed Mull Ridge	1,530	2,230	<i>Cyrilla racemiflora</i> - <i>Clethra occidentalis</i> (dominant species)



Figure 3. Mor Ridge sub-site at the John Crow Ridge tropical forest site, Jamaica. (Leaning tree in foreground is *Clusia* cf. *havetioides*; bromeliads are *Tillandsia complanata* and *Vriesia sintenisii*; herbs at ground level are *Elaphoglossum latifolium* and *Peperomia clusiifolia*. Photograph taken February 1975 by Dr. E. V. J. Tanner, Cambridge University, UK). (JHN-3.jpg)



Figure 4. Mull Ridge sub-site at the John Crow Ridge tropical forest site, Jamaica. (Species include *Clethra occidentalis*, which has contributed most of the fresh litter; *Hedyosmum arborescens* and *Podocarpus urbanii*. Photograph taken February 1975 by Dr. E. V. J. Tanner, Cambridge University, UK). (JHN-4.jpg)



Figure 5. Wet Slope sub-site at the John Crow Ridge tropical forest site, Jamaica. (Species include *Clethra occidentalis*, *Hedyosmum arborescens*, *Cyrtia racemiflora* and *Cyathea pubescens*, which was always short-stemmed on the Wet Slope. Photograph taken February 1975 by Dr. E. V. J. Tanner, Cambridge University, UK). (JHN-5.jpg)



Figure 6. Gap Forest sub-site at the John Crow Ridge tropical forest site, Jamaica. (Species include *Cyathea pubescens*, *Cyathea furfuracea* and *Hedyosmum arborescens*. Photograph taken February 1975 by Dr. E. V. J. Tanner, Cambridge University, UK). (JHN-6.jpg)

Spatial Resolution

The forest plots for biomass estimation by destructive methods at Mor Ridge and well-developed Mull Ridge sites were 10 x 10 m in size. Herbs were harvested from 2 m² sub-plots at Mor Ridge and from 1 m² sub-plots at well-developed Mull Ridge. Tree seedlings and saplings were harvested from 1 m² sub-plots at both sites. The distribution of seedlings and saplings in 100 sub-plots of 1 m² was recorded in one plot of 10 x 10 m at the Mor Ridge forest before harvest. Roots were excavated from pits 3.5 x 5 m in size to a depth of 50 cm at the Mor Ridge site. Above-ground biomass was estimated by regression analysis at the other three sites. Litter traps at all five sub-sites were 1 m² in size. Large material (branches and tree fern leaves) was collected separately. The sample area for estimating the standing crop of leaf litter at the sub-sites was 281 cm².

Temporal Coverage

Forest vegetation species were inventoried and measured at the Mor Ridge site in January and February 1974. Above- and below-ground biomass was measured by destructive harvest at the Mor Ridge site in January 1975. Above-ground biomass was harvested at the well-developed Mull Ridge site in September 1977; roots were not sampled. Element concentrations in leaves were analyzed from samples taken from Mor Ridge in 1975 and 1976. LAI measurements were made at Mor Ridge in January 1975 and at the well-developed Mull Ridge site in September 1977. Standing crop of leaf litter was measured on three occasions in 1974 at the Mor Ridge, Mull Ridge, Wet Slope, and Gap Forest sites: February 20, July 5, and November 23. Litterfall was measured from March 7, 1974 to March 7, 1975 at these same sites, and again from April 17, 1977 to April 17, 1978 at the Mull Ridge site. Litterfall was measured at the well-developed Mull Ridge site in 1976-77. Changes in tree biomass were measured from February 1974 to April 1978 at the Mor Ridge, Mull Ridge, Wet Slope, and Gap Forest sites. Tree mortality was recorded in 1977-78 at Mull Ridge, Wet Slope, and Gap Forest sites, three to four years after the biomass enumeration surveys at these sites. Temperature, rainfall, throughfall, relative humidity, litterfall and water content of the trapped litter were studied at the sites for varying lengths of time.

Long term climate data are available from the weather station at Cinchona Botanic Gardens near John Crow Ridge, Jamaica for four different periods: 1871-1909 (mean monthly and annual precipitation); 1891-1905 (mean monthly and annual maximum/minimum temperature); 1951-1980 (mean monthly and annual precipitation and maximum/minimum temperature); and 1901-1983 (monthly and annual precipitation).

Temporal Resolution

Biomass and LAI measurements were made once. Litter on the forest floor was collected on three occasions, 4-5 months apart. Litterfall was collected approximately every 2 weeks (1974-1975) and monthly (1977-1978). Dendrometer readings were made intermittently over the 1974-78 period. All NPP estimates are based on plant dry matter accumulation, expressed as g/m² (dry matter weight).

Climate data are expressed as monthly and annual precipitation amounts (mm) and monthly and annual average maximum/minimum temperature (C).

Monthly and annual climatic means are also provided.

Data File Information

Table 3. Data files in this data set archive

FILE NAME	FILE SIZE	TEMPORAL COVERAGE	FILE CONTENTS
jhn1_npp.txt	5.0 KB	1974/02/20-1975/03/07	Biomass, litterfall, LAI, and ANPP data for Mor Ridge site at at John Crow Ridge, Jamaica
jhn2_npp.txt	5.1 KB	1974/02/20-1978/04/17	Biomass, litterfall, tree mortality, and ANPP data for Mull Ridge site at at John Crow Ridge, Jamaica
jhn3_npp.txt	3.8 KB	1974/02/20-1975/03/07	Biomass, litterfall, tree mortality, and ANPP data for Wet Slope site at at John Crow Ridge, Jamaica
jhn4_npp.txt	3.7 KB	1974/02/20-1975/03/07	Biomass, litterfall, tree mortality, and ANPP data for Gap Forest site at at John Crow Ridge, Jamaica
jhn5_npp.txt	1.8 KB	1976/01/01-1977/12/31	Biomass, litterfall, and ANPP data for Well-developed Mull Ridge site at at John Crow Ridge, Jamaica
jhn1_cli.txt	4 KB	1891/01/01-1905/12/31	Mean (based on all years) monthly and annual maximum/minimum temperature data from weather station at Cinchona Botanic Gardens near John Crow Ridge, Jamaica
		1871/01/01-1909/12/31	Mean (based on all years) monthly and annual precipitation data from weather station at Cinchona Botanic Gardens near John Crow Ridge, Jamaica
jhn2_cli.txt	4 KB	1951/01/01-1980/12/31	Mean (based on all years) monthly and annual precipitation and maximum/minimum temperature data from weather station at Cinchona Botanic Gardens near John Crow Ridge, Jamaica
jhn3_cli.txt	12 KB	1901/01/01-1983/03/31	Mean monthly and annual precipitation data from weather station at Cinchona Botanic Gardens near John Crow Ridge, Jamaica

NPP Data. NPP estimates for the John Crow Ridge site are provided in five files, one for each study site (Table 3). The data sets are ASCII files (.txt format). The variable values are delimited by semi-colons. The first 18 lines are metadata; data records begin on line 19. The value -999.9 is used to denote missing values. Biomass and NPP units are in g/m² and g/m²/year (dry matter weight), respectively.

Table 4. Column headings in NPP files

COLUMN HEADINGS	DEFINITION	UNITS
Site	Site where data were gathered (code refers to site identification)	Text
Treatmt	Study area or forest subsystem type where measurements were made	Text
Year	Year in which data were collected	Numeric
Month	Month in which data were collected	
Day	Day on which data were collected	
parameter	Parameters measured (see definitions in Table 4)	Text

amount	Data values	Numeric
units	Unit of measure	Text
Comments	Explanatory comments	Text

Table 5. Parameter definitions in NPP files

PARAMETER	DEFINITION	UNITS	SOURCE
height	Forest canopy height	m	Table 1 ¹
litter	Leaf litter standing crop at different times of the year	g/m ²	Table 3 ²
leaves	Total tree leaf biomass	g/m ²	Tables 1 & 2 ¹
trunks+branches	Tree trunk and branch biomass	g/m ²	Table 2 ¹
climbers+epiphytes	Biomass of bromeliads, hemi-parasites, and other epiphytes		
Undstory	Sum of seedlings and sapling biomass + tree fern biomass + herb biomass		
AGbiomass	Total above-ground biomass	g/m ²	by addition
Stdead	Biomass of standing dead branches and trees	g/m ²	Table 2 ¹
branchlitter	Biomass of dead wood on the ground		
roots<2cm	Biomass of roots < 2 cm diameter		
roots2-10cm	Biomass of roots 2-10 cm diameter		
roots>10cm	Biomass of roots > 10 cm diameter		
Totroots	Total root biomass		
LAI_trees	Leaf area index for trees	m ² /m ²	p. 583, Tanner (1980a)
LAI_other	Leaf area index for bromeliads + tree saplings and seedlings + herbs		
LAI	Total leaf area index		by addition
leaflittfall	Litterfall biomass of leaves and other material (mainly leaves)	g/m ² /year	Table 2 ³
woodlittfall	Litterfall biomass of woody material		
otherlittfall	Litterfall biomass of epiphytic material (mainly bromeliads)		
Totlittfall	Total litterfall biomass		
trunk+branch_incr	Estimate of wood production	g/m ² /year	Table 6 ³
ANPP	Above-ground net primary production (sum of total litterfall + wood production)	g/m ² /year	Table 6 ³
mortality	Loss of live above-ground biomass due to trunk deaths	g/m ² /year	p. 584, Tanner (1980a)

litterfall	Mean litterfall in the four forest sites at each collection (1974-1975)	g/m ²	Appendix 1 ³
litterfall	Mean litterfall in the Mull Ridge site at each collection (1977-1978)	g/m ²	Appendix 1 ³
leaves-N	Mean foliar concentration of nitrogen in leaves	percent	Table 16 ⁴
leaves-P	Mean foliar concentration of phosphorus in leaves		
leaves-K	Mean foliar concentration of potassium in leaves		

Notes: Some of the data files do not contain all of the parameters listed in this table. ¹Tanner (1980a). ²Tanner (1981). ³Tanner (1980b). ⁴Tanner (1977).

Sample NPP Data Record <jhn1_npp.txt>

```
Site; Treatmt; Year; Month; Day; parameter; amount; units; Comments
jhn; Morridge; 1974-75; -999.9; -999.9; height; 5-8; m
jhn; Morridge; 1974; 2; 20; litter; 1010; g/m2
jhn; Morridge; 1974; 7; 5; litter; 1310; g/m2
jhn; Morridge; 1974; 11; 23; litter; 1000; g/m2
jhn; Morridge; 1975; 1; -999.9; leaves; 790; g/m2
jhn; Morridge; 1975; 1; -999.9; trunks+branches; 21500; g/m2
jhn; Morridge; 1975; 1; -999.9; climbers+epiphytes; 280; g/m2
jhn; Morridge; 1975; 1; -999.9; Undstory; 500; g/m2
jhn; Morridge; 1975; 1; -999.9; AGbiomass; 23070; g/m2 ...
```

Sample NPP Data Record <jhn2_npp.txt>

```
Site; Treatmt; Year; Month; Day; parameter; amount; units
jhn; Mulridge; 1974-75; -999.9; -999.9; height; 8-13; m
jhn; Mulridge; 1974; 2; 20; litter; 1070; g/m2
jhn; Mulridge; 1974; 7; 5; litter; 1500; g/m2
jhn; Mulridge; 1974; 11; 23; litter; 940; g/m2
jhn; Mulridge; 1975; -999.9; -999.9; AGbiomass; 31200; g/m2; estimated by regression
jhn; Mulridge; 1974-75; -999.9; -999.9; leaflittfall; 532; g/m2/year
jhn; Mulridge; 1974-75; -999.9; -999.9; woodlittfall; 22; g/m2/year
jhn; Mulridge; 1974-75; -999.9; -999.9; otherlittfall; 0; g/m2/year
jhn; Mulridge; 1974-75; -999.9; -999.9; Totlittfall; 554; g/m2/year
jhn; Mulridge; 1974-75; -999.9; -999.9; ANPP; 654; g/m2/year ...
```

Sample NPP Data Record <jhn3_npp.txt>

```
Site; Treatmt; Year; Month; Day; parameter; amount; units
jhn; Wetslope; 1974-75; -999.9; -999.9; height; 8-13; m
jhn; Wetslope; 1974; 2; 20; litter; 1200; g/m2
jhn; Wetslope; 1974; 7; 5; litter; 981; g/m2
jhn; Wetslope; 1974; 11; 23; litter; 898; g/m2
jhn; Wetslope; 1975; -999.9; -999.9; AGbiomass; 23000; g/m2; estimated by regression
jhn; Wetslope; 1974-75; -999.9; -999.9; leaflittfall; 436; g/m2/year
jhn; Wetslope; 1974-75; -999.9; -999.9; woodlittfall; 116; g/m2/year
jhn; Wetslope; 1974-75; -999.9; -999.9; otherlittfall; 3; g/m2/year
jhn; Wetslope; 1974-75; -999.9; -999.9; Totlittfall; 555; g/m2/year
jhn; Wetslope; -999.9; -999.9; -999.9; trunk+branch_incr; 200; g/m2/year
jhn; Wetslope; 1974-75; -999.9; -999.9; ANPP; 755; g/m2/year
jhn; Wetslope; 1974-78; -999.9; -999.9; mortality; 270; g/m2/year ...
```

Sample NPP Data Record <jhn4_npp.txt>

```

Site; Treatmt; Year; Month; Day; parameter; amount; units
jhn; Gap; 1974-75; -999.9; -999.9; height; 12-16; m

jhn; Gap; 1974; 2; 20; litter; 700; g/m2
jhn; Gap; 1974; 7; 5; litter; 1010; g/m2
jhn; Gap; 1974; 11; 23; litter; 706; g/m2
jhn; Gap; 1975; -999.9; -999.9; AGbiomass; 23800; g/m2; estimated by regression

jhn; Gap; 1974-75; -999.9; -999.9; leaflittfall; 550; g/m2/year
jhn; Gap; 1974-75; -999.9; -999.9; woodlittfall; 91; g/m2/year
jhn; Gap; 1974-75; -999.9; -999.9; otherlittfall; 6; g/m2/year
jhn; Gap; 1974-75; -999.9; -999.9; Totlittfall; 647; g/m2/year
jhn; Gap; -999.9; -999.9; -999.9; trunk+branch_incr; 350; g/m2/year
jhn; Gap; 1974-75; -999.9; -999.9; ANPP; 997; g/m2/year
jhn; Gap; 1974-78; -999.9; -999.9; mortality; 60; g/m2/year ...
    
```

Sample NPP Data Record <jhn5_npp.txt>

```

Site; Treatmt; Year; Month; Day; parameter; amount; units; Comments
jhn; WDMulrdg; 1976-77; -999.9; -999.9; height; 15?; m

jhn; WDMulrdg; 1977; 9; -999.9; leaves; 640; g/m2
jhn; WDMulrdg; 1977; 9; -999.9; trunks+branches; 32300; g/m2
jhn; WDMulrdg; 1977; 9; -999.9; climbers+epiphytes; 287; g/m2
jhn; WDMulrdg; 1977; 9; -999.9; Undstory; 522; g/m2
jhn; WDMulrdg; 1977; 9; -999.9; AGbiomass; 33749; g/m2; estimated value from regression = 40700 g/m2
jhn; WDMulrdg; 1977; 9; -999.9; Stdead; 980; g/m2
jhn; WDMulrdg; 1977; 9; -999.9; branchlitter; 220; g/m2 ...
    
```

Climate Data. The climate data for John Crow ridge are provided in three ASCII files (.txt format). The first 18 lines are metadata; data records begin on line 19. The variable values are delimited by semi-colons. The value -999.9 is used to denote missing values.

Sample Climate Data Record <jhn1_cli.txt>

```

Site;Temp;Parm; Jan; Feb; Mar; Apr; May; Jun; Jul; Aug; Sep; Oct; Nov; Dec; Year
jhn ;mean;prec; 179.8; 101.9; 132.8; 156.5; 271.3; 206.0; 96.5; 204.2; 247.1; 454.9; 363.0; 270.8; 2684.8
jhn ;mean;tmax; 19.4; 19.4; 19.4; 19.7; 20.2; 21.1; 22.2; 22.1; 21.4; 20.4; 20.2; 18.9; 20.4
jhn ;mean;tmin; 11.9; 12.1; 12.2; 12.9; 14.1; 14.6; 14.9; 14.9; 15.2; 14.8; 14.1; 12.8; 13.7 ...

Where,
Temp (temporal) - specific year or long-term statistic:
  mean = mean based on all years (temperature, 1891-1905; precipitation, 1871-1909)
Parm (parameter):
  prec = precipitation for month or year (mm)
  tmax = mean maximum temperature for month or year (C)
  tmin = mean minimum temperature for month or year (C)
    
```

Sample Climate Data Record <jhn2_cli.txt>

```

Site;Temp;Parm; Jan; Feb; Mar; Apr; May; Jun; Jul; Aug; Sep; Oct; Nov; Dec; Year
jhn ;mean;prec; 126; 116; 103; 172; 219; 141; 79; 179; 226; 343; 396; 235; 2335
jhn ;mean;tmax; 20.0; 19.9; 21.0; 21.5; 21.8; 22.9; 23.7; 23.7; 23.0; 21.9; 21.1; 20.4; 21.7
jhn ;mean;tmin; 11.9; 11.7; 12.0; 12.6; 13.5; 14.2; 14.7; 15.0; 14.4; 14.5; 14.0; 12.9; 13.5 ...

Where,
Temp (temporal) - specific year or long-term statistic:
  mean = mean based on all years (1951-1980)
Parm (parameter):
  prec = precipitation for month or year (mm)
  tmax = mean maximum temperature for month or year (C)
  tmin = mean minimum temperature for month or year (C)
    
```

Sample Climate Data Record <jhn3_cli.txt>

```

Site;Temp;Parm; Jan; Feb; Mar; Apr; May; Jun; Jul; Aug; Sep; Oct; Nov; Dec; Year
    
```

```
jhn ;mean;prec; 138.8; 116.0; 91.7; 134.5; 214.8; 156.3; 82.1; 187.9; 227.5; 363.8; 429.6; 224.4; 2366.3
jhn ;numb;prec; 79; 78; 79; 79; 79; 79; 79; 79; 79; 78; 78; 78; 76
jhn ;stdv;prec; 105.7; 99.4; 80.5; 108.8; 137.4; 150.9; 61.4; 182.6; 159.8; 256.6; 391.6; 166.1; 776.4
jhn ;1901;prec; -999.9; -999.9; -999.9; 29.0; 172.0; 484.0; 121.0; 92.0; 521.0; 459.0; -999.9; 190.0; -999.9
jhn ;1902;prec; 81.0; 63.0; 310.0; 128.0; 354.0; 323.0; 33.0; 75.0; 43.0; 201.0; 130.0; 370.0; 2111.0
jhn ;1903;prec; 24.0; 26.0; 38.0; 213.0; 329.0; 69.0; 7.0; 597.0; 66.0; 111.0; 295.0; 381.0; 2156.0 ...
```

Where,

Temp (temporal) - specific year or long-term statistic:

mean = mean based on all years

numb = number of years

stdv = standard deviation based on all years

Parm (parameter):

prec = precipitation for month or year (mm)

Missing values = -999.9

3. Data Application and Derivation:

Tanner (1977; 1980a, b; and 1981) investigated the controlling factors which produce forests that are relatively poor in species composition and low in stature on mountains in the tropics. In particular, he wanted to find out why such low-stature forests occur at lower altitudes and in compressed vegetation zones on small tropical wet mountains (compared to large tropical wet mountains) -- the tropical *Massenerhebung* effect of Richards (1952) and Grubb (1974).

The tropical forest biomass dynamics data for the John Crow Ridge sites are provided for comparison with models and estimation of NPP. Climate data are provided for use in driving ecosystem/NPP models.

4. Quality Assessment:

Comparisons of the five Jamaican montane forest types were made by Tanner (1977; 1980a, b; and 1981) with forests elsewhere in the tropics. Tanner's studies considered various aspects of the forests, including above- and below-ground biomass, litterfall, leaf structure and mineral content, litter on the forest floor, wood production, and tree mortality.

Sources of Error

Information not available.

5. Data Acquisition Materials and Methods:

Forest Structure. In January-February 1974, eight contiguous plots of 10 x 10 m in two rows were marked out at the Mor Ridge forest site, and ten such plots were established at each of the other sites (Mull Ridge, Wet Slope and Gap Forest). All stems ≥ 10 cm dbh were measured and the species recorded. Tree-ferns were measured in the same way as angiosperm trees. The distribution of seedlings and saplings in 100 sub-plots of 1 m² was recorded in one plot of 10 x 10 m in the Mor Ridge forest.

Biomass. In January 1975 one square plot, 10 x 10 m in size, at the Mor Ridge site was selected for biomass estimation from the eight Mor Ridge forest plots. All herbs (mainly *Elaphoglossum latifolium* and *Peperomia clusiifolia*) were removed and weighed separately for each 2 m² sub-plot. Tree seedlings and saplings (< 10 cm dbh) in each 1 m² were classified into those < 1 m tall and those > 1 m tall; both classes were removed and weighed. The trees (≥ 10 cm dbh) that branched below breast height (1.3 m) were treated as separate trees, and those that branched between ground level and 1.3 m were harvested as one tree. Trees were cut and weighed after dividing the above-ground part into trunk, branches, leafy twigs, bromeliads, hemi-parasites, and other epiphytes.

Roots were dug from a rectangular area 3.5 x 5.0 m in size to a depth of 50 cm, and weighed in three diameter size-classes: < 2 cm; 2-10 cm; and > 10 cm. All material was weighed fresh in the forest, and samples were taken of every category of every individual to determine dry-weight conversion factors.

In order to obtain an indication as to whether the regression for the Mor Ridge forest could be applied to the other forest-types, two trees in the Gap Forest site (including one of the largest trees at the site) and four in the Mull Ridge forest site, or close to it, were felled and weighed.

In September 1977, a 10 x 10 m plot was established at the well-developed Mull Ridge forest for biomass estimation, on the basis of being near the mean for total basal area for the original Mull Ridge forest plots. Herbs were uncommon in this plot (a feature typical of Mull Ridge, Wet Slope and Gap Forest sites); those present (mainly the orchids *Erythroides plantaginea* and *Prescottia stachyodes*, and the fern *Polypodium loreum*) were removed and weighed separately for each 1 m² sub-plot. Tree seedlings and saplings (< 10 cm dbh) were divided into three categories: < 1 m tall; > 1 m tall but < 2.5 m tall; and those > 2.5 m tall. Seedlings and saplings were removed from 1 m² sub-plots and weighed. The trees (≥ 10 cm dbh) were harvested. Roots were not sampled. Climbers were divided into woody axes and leafy shoots before being weighed and subsampled. All material was weighed fresh in the forest. Subsamples were taken of every category of every individual to determine dry-weight conversion factors

LAI. Specific leaf area was measured for all the trees, bromeliads, saplings and seedlings, and ground vegetation harvested and sampled at Mor Ridge and well-developed Mull Ridge sites. Leaves were wetted for c. 24 h before pressing them flat and determining their area by a Lambda leaf-area meter, model LI-3000.

Changes in the Biomass. In February 1974, dendrometers were fitted at a height of 1.3 m on 69 trees scattered through the Mor Ridge, Mull Ridge, Wet Slope and Gap Forest sites. The dendrometers, accurate to 0.1 mm diameter, were read intermittently until April 1978. The biomass increment (from basal area and regression equations) was calculated for each tree. The mean for the trees in each forest-site (18 in Mor Ridge forest; 19 in Mull Ridge forest; 10 in Wet Slope forest, and 13 in Gap Forest) was used to calculate the increment for each forest site.

Mortality. Twenty-three of the plots enumerated in 1974 at Mull Ridge, Wet Slope, and Gap Forest sites were re-checked in 1977-78, and the trunks which had died were recorded.

Litterfall. Litterfall was measured for the 12-month period 7 March 1974 to 7 March 1975 in the Mor Ridge, Mull Ridge, Wet Slope, and Gap Forest sites, and again from 17 April 1977 to 17 April 1978 in the Mull Ridge site.

- 1974-1975. Litterfall was studied at two plots at each site chosen because their basal area (and therefore biomass) was similar to the mean basal area for their forest site. Ten 1 m² litter traps were placed at random in each forest-type. Each trap was made of 2-mm-mesh nylon, suspended from galvanized wire supported by four bamboo poles at a height of 50 cm, and allowed to droop to a depth of c. 25 cm; each was weighted with a piece of wood to prevent it blowing inside out. Litter was collected from the traps into self-seal polythene bags approximately every 2 weeks; large material (branches and tree fern leaves) was collected separately. The litter was taken to Kingston to be fresh weighed, and then dried at c. 60 C and reweighed. All litter collected in this way was brought to Cambridge, England, where a correction factor for drying at 100 C was determined on sixteen samples. The litter from three collections (those of 19 March 1974, 8 August 1974, and 7 March 1975) was bulked into twelve samples, one per site per collection. Each of these twelve samples was sorted into woody material, epiphytic material and other material (mainly leaves). Mean results for the composition of these collections were used as an estimate of the composition of all other litter collected, except the collection of 8 September 1974. This was sorted separately because it was largely the result of a hurricane which passed near the island during the preceding collection period; due to the high winds, woody and epiphytic material were present in greater proportions than usual.
- 1977-1978. Litterfall was studied in ten enumerated plots in the Mull Ridge forest site. Thirty-eight litter traps, made of 2-mm-mesh nylon supported by an equilateral triangular frame of spring steel, of side 76 cm (area 0.29 m²), c. 50 cm off the ground at the edges and c. 25 cm deep, were set up on a stratified-random basis. Litter was collected from the traps into self-seal polythene bags approximately every month; it was taken to Kingston where it was fresh weighed, dried at 100 C and reweighed.

Standing Crop of Leaf Litter. The standing crop was determined in 1974 on 20 February, 5 July and 23 November. Ten random samples (each 281 cm²) were collected from each site on each occasion. All woody material was removed from the samples at the time of collection; the remainder of the sample is considered to be the standing crop of leaf litter.

Foliar Analyses. Element concentrations in tree leaves from the Mor Ridge, Mull Ridge, Wet Slope, and Gap Forest sites were analyzed using standard laboratory methods described in Tanner (1977).

Climate. Long term climate was monitored at the Cinchona Botanic Gardens, approximately 3 km south of the John Crow Ridge study area and at similar elevation (1,525 m).

Soil Profiles. Methods are described in Tanner (1977). Data are not included in this data set.



Figure 7. Soil profile at the Mor Ridge sub-site, John Crow Ridge tropical forest site, Jamaica. (Note 40-50 cm of mor humus ['duff' in USA]. Scale pole divisions are 12 inches [305 mm]. Photograph taken February 1975 by Dr. E. V. J. Tanner, Cambridge University, UK). (JHN-7.jpg)



Figure 8. Soil profile at the Mull Ridge sub-site, John Crow Ridge tropical forest site, Jamaica. (Scale pole divisions are 12 inches [305 mm]. Photograph taken February 1975 by Dr. E. V. J. Tanner, Cambridge University, UK). (JHN-8.jpg)



Figure 9. Soil profile at the Wet Slope sub-site, John Crow Ridge tropical forest site, Jamaica. (Note that weathering rock fragments at about 30 cm depth prevent further penetration with a spade. Scale pole divisions are 12 inches [305 mm]. Photograph taken February 1975 by Dr. E. V. J. Tanner, Cambridge University, UK). (JHN-9.jpg)



Figure 10. Soil profile at the Gap Forest sub-site, John Crow Ridge tropical forest site, Jamaica. (In the upper part of the profile, note the absence of mor humus, and relatively little dark brown staining by mull humus, compared to Mor Ridge soil and Mull ridge soil, respectively. This is despite the fact that total litterfall rates are rather similar at all three sub-sites [661 g/m²/yr Mor; 554-580 g/m²/yr Mull; 647 g/m²/yr Gap Forest]. Scale pole divisions are 12 inches [305 mm]. Photograph taken February 1975 by Dr. E .V. J. Tanner, Cambridge University, UK). (JHN-10.jpg)

6. Data Access:

This data set is available through the Oak Ridge National Laboratory (ORNL) Distributed Active Archive Center (DAAC).

Data Archive:

Web Site: <http://daac.ornl.gov>

Contact for Data Center Access Information:

E-mail: uso@daac.ornl.gov

Telephone: +1 (865) 241-3952

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