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Flora and dynamics of an upland and a floodplain forest in Peña Roja, Colombian Amazonia = Flora y dinámica de bosques de tierra firme y de várzea en Peña Roja, Amazonia colombiana

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Literature

- Achard, F., Eva, H. D., Stibig, H.-J., Mayaux, P., Gallego, J., Richards, T. & Malingreau, J.-P. (2002) Determination of deforestation rates of the world's humid tropical forests. *Science*, 297, 999-1002.
- Alarcón, N. H. (1990) Levantamiento muy detallado de suelos en Villa Azul. *Colombia Amazónica*, 4, 149-157.
- Alcaraz, E. (2001) Evaluación de la dinámica de un bosque de tierra firme en la Amazonia colombiana (período 1994-1998). Tesis B.Sc. (Ingeniería Forestal), Universidad Nacional de Colombia sede Medellín, Medellín.
- Alder, D. & Synnott, T. J. (1992) Permanent sample plot techniques for mixed tropical forest. Oxford University Press, Oxford.
- Álvarez, E. (1993) Composición florística, diversidad, estructura y biomasa de un bosque inundable en la Amazonia colombiana. Tesis M.Sc. (Biología), Universidad de Antioquia, Medellín.
- Álvarez, E., Cogollo, Á., Melo, O., Rojas, E., Sánchez, D., Velásquez, O., Sarria, E., Jiménez, E., Benítez, D., Velásquez, C., Serna, M., Londoño, A. C., Stevenson, P., Galeano, G., Peñuela, M. C., García, F., Ramos, Y., Palacios, J. & Patiño, S. (2008) Red de parcelas permanentes para el monitoreo de los bosques nativos de Colombia., pp. 56. Medellín.
- Ashton, P. S. (1982) Dipterocarpaceae. *Flora Malesiana*, Ser. I, 9, 237-552.
- Ashton, P. S. (1990) Species richness in tropical forests. In: *Tropical forests: Botanical dynamics, speciation and diversity* (eds L. B. Holm-Nielsen, I. C. Nielsen & H. Balslev), pp. 239-251. Academic Press, London.
- Baker, T. R., Burslem, D. F. R. P. & Swaine, M. D. (2003) Associations between tree growth, soil fertility and water availability at local and regional scales in Ghanaian tropical rain forest. *Journal of Tropical Ecology*, 19, 109-125.
- Baker, T. R., Phillips, O. L., Malhi, Y., Almeida, S., Arroyo, L., Di Fiore, A., Erwin, T., Higuchi, N., Killeen, T. J., Laurance, S. G., Laurance, W. F., Lewis, S. L., Monteagudo, A., Neill, D. A., Núñez Vargas, P., Pitman, N. C. A., J., Silva, N. M. & Vásquez Martínez, R. (2004) Increasing biomass in Amazonian forest plots.

- Philosophical Transactions of the Royal Society, London, Series B, 359, 353-365.
- Bakker, J. P., Olf, H., Willems, J. H. & Zobel, M. (1996) Why do we need permanent plots in the study of long-term vegetation dynamics? *Journal of Vegetation Science*, 7, 147-156.
- Balslev, H. & Renner, S. S. (1990) Diversity of East Ecuadorean lowland forests. In: *Tropical forests: Botanical dynamics, speciation and diversity* (eds L. B. Holm-Nielsen, I. C. Nielsen & H. Balslev), pp. 288-295 Academic Press, London.
- Balslev, H., Luteyn, J., Ollgaard, B. & Holm-Nielsen, L. B. (1987) Composition and structure of adjacent unflooded and flooded forest in Amazonian Ecuador. *Opera Botanica*, 92, 37-57.
- Bancroft, H. (1935) The wood anatomy of representative members of the Monotoideae. *American Journal of Botany*, 22, 717-739.
- Barthélémy, D. (1991) Levels of organization and repetition phenomena in seed plants. *Acta Biotheoretica*, 39, 309-323.
- Barthélémy, D., Édelin, C. & Hallé, F. (1991) Canopy architecture. In: *Physiology of trees* (ed. A. S. Raghavendra), pp. 1-20. John Wiley & Sons, New York.
- Bell, A. D. (1993) *Plant form: An illustrated guide to flowering plant morphology*. Oxford University Press, Oxford.
- Bell, T. I. W. (1971) Management of the Trinidad Mora forests with special reference to the Matura Forest Reserve. Forestry Division, Trinidad and Tobago, Trinidad.
- Benavides, A. M. (2010) Distribution and succession of vascular epiphytes in Colombian Amazonia. Ph.D. Thesis, Universiteit van Amsterdam, Amsterdam.
- Bennett, B. C. & Alarcón, R. (1994) *Osteophloeum platyspermum* and *Virola duckei* (Myristicaceae): Newly reported as hallucinogens from Amazonian Ecuador. *Economic Botany*, 48, 152-158.
- Bigarella, J. J. & Ferreira, A. M. M. (1985) Amazonian geology and the Pleistocene and the Cenozoic environments and paleoclimates. In: *Amazonia* (eds G. T. Prance & T. Lovejoy), pp. 49-71. Pergamon Press, Oxford.
- Botero, P. J. (1984) Relación fisiografía-suelos-aptitud de uso de la tierra en la Amazonia colombiana. *Revista CIAF*, 9, 3-23.

- Botero, P. J. (1999) Paisajes fisiográficos de la Orinoquia-Amazonia (ORAM) Colombia. *Análisis Geográficos* 27-28, Instituto Geográfico Agustín Codazzi, Bogotá.
- Brako, L. & Zarucchi, J. L. (1993) Catalogue of the flowering plants and gymnosperms of Perú. Missouri Botanical Garden, Saint Louis.
- Brown, S. (1997) Estimating biomass and biomass change of tropical forests: A primer. FAO, Rome.
- Brown, S. (2002) Measuring carbon in forests: Current status and future challenges. *Environmental Pollution*, 116, 363-372.
- Brünig, E. F. & Huang, Y. W. (1990) Patterns of tree species diversity and canopy structure and dynamics in humid tropical evergreen forests on Borneo and in China. In: *Tropical forests: Botanical dynamics, speciation and diversity* (eds L. B. Holm-Nielsen, I. C. Nielsen & H. Balslev), pp. 75-88. Academic Press, London.
- Cailleux, F. (1980) Estimación del volumen forestal y predicción del rendimiento, con referencia especial a los trópicos. FAO, Roma.
- Campbell, D. G., Daly, D. C., Prance, G. T. & Maciel, U. N. (1986) Quantitative ecological inventory of terra firme and várzea tropical forest on the río Xingú, Brazilian Amazon. *Brittonia*, 38, 369-393.
- Campbell, P., Comiskey, J., Alonso, A., Dallmeier, F., Nuñez, P., Beltran, H., Baldeon, S., Nauray, W., de la Colina, R., Acurio, L. & Udvardy, S. (2002) Modified Whittaker plots as an assessment and monitoring tool for vegetation in a lowland tropical rainforest. *Environmental Monitoring and Assessment*, 76, 19-41.
- Canadell, J. G., Mooney, H. A., Baldocchi, D. D., Berry, J. A., Ehleringer, J. R., Field, C. B., Gower, S. T., Hollinger, D. Y., Hunt, J. E., Jackson, R. B., Running, S. W., Shaver, G. R., Steffen, W., Trumbore, S. E., Valentini, R. & Bond, B. Y. (2000) Carbon metabolism of the terrestrial biosphere: A multitechnique approach for improved understanding. *Ecosystems*, 3, 115-130.
- Carey, E. V., Brown, S., Gillespie, A. J. R. & Lugo, A. E. (1994) Tree mortality in mature lowland tropical moist and tropical lower montane moist forests of Venezuela. *Biotropica*, 26, 255-265.
- Chao, K.-J., Phillips, O. L., Gloor, E., Monteagudo, A., Torres Lezama, A. & Vásquez-Martínez, R. (2008) Growth and wood density predict tree mortality in Amazon forests. *Journal of Ecology*, 96, 281-292.

- Clark, D. A. & Clark, D. B. (1994) Climate induced annual variation in canopy tree growth in a Costa Rican tropical rain forests. *Journal of Ecology*, 82, 865-872.
- Clark, D. A. & Clark, D. B. (1999) Assessing the growth of tropical rain forest trees: issues for forest modelling and management. *Ecological Applications*, 9, 981-997.
- Clark, D. A., Piper, S. C., Keeling, C. D. & Clark, D. B. (2003) Tropical rain forest tree growth and atmospheric carbon dynamics linked to interannual temperature variation during 1984-2000. *Proceedings of National Academy of Science*, 100, 5852-5857.
- Clark, D. B. (1990) The role of disturbance in the regeneration of Neotropical moist forests. *Reproductive ecology of tropical forest plants.* (eds K. S. Bawa & M. Hadley), pp. 291-315. UNESCO and the Parthenon Publishing Group, Paris.
- Clark, J. S., Beckage, B., Camill, P., Cleveland, B., HilleRisLambers, J., Lichter, J., McLachlan, J., Mohan, J. & Wyckoff, P. (1999) Interpreting recruitment limitation in forests. *American Journal of Botany*, 86, 1-16.
- Comiskey, J., Dallmeier, F. & Mistry, S. (1999) Protocolo de muestreo de vegetación para la Selva Maya. En: *Monitoreo biológico en la Selva Maya* (eds A. Carr & A. C. de Stoll), pp. 18-27. US Man and the Biosphere, Tropical Ecosystem Directorate y Wildlife Conservation Society, Guatemala.
- Comte, L. (1993) Rythmes de croissance et structures spatiales périodiques d'arbres tropicaux: Exemples de cinq espèces de forêt équatoriale. Ph.D. Thesis, Université Montpellier II, Sciences et Techniques du Languedoc, Montpellier.
- Condit, R. (1998) *Tropical forest census plots : methods and results for Barro Colorado Island, Panama and a comparison with other plots.* Springer, Berlin.
- Condit, R., Hubbell, S. P. & Foster, R. B. (1995) Mortality rates of 205 Neotropical tree and shrub species and their responses to severe drought. *Ecological Monographs*, 65, 419-439.
- Condit, R., Hubbell, S. P. & Foster, R. (1996) Changes in tree species abundance in a Neotropical forest over eight years: Impact of climate change. *Journal of Tropical Ecology*, 12, 231-256.

- Cronquist, A. (1981) An integrated system of classification of flowering plants. Columbia University Press, New York.
- Crow, T. R. (1980) A rainforest chronicle: A 30-year record of change in structure and composition at El Verde, Puerto Rico. *Biotropica*, 12, 42-45.
- Crow, T. R. & Weaver, P. L. (1977) Tree growth in moist tropical forest of Puerto Rico. Research Paper ITF-22, USDA Forest Service, Institute of Tropical Forestry, Rio Pedras, Puerto Rico.
- Curtis, H. T. & McIntosh, R. J. (1951) An upland forest continuum in the prairie-forest border region of Wisconsin. *Ecology*, 32, 476-496.
- D'Angelo, S. A., Andrade, A. C. S., Laurance, S. G., Laurance, W. F. & Mesquita, R. C. G. (2004) Inferred causes of tree mortality in fragmented and intact Amazonian forests. *Journal of Tropical Ecology*, 20, 243-246.
- Dallmeier, F. (1992) Long-term monitoring of biological diversity in tropical forest areas: Methods for establishment and inventory of permanent plots. MAB Digest 11. UNESCO, Paris.
- Daly, D. C. & Prance, G. T. (1989) Brazilian Amazon. In: Floristic inventory of tropical countries (eds D. G. Campbell & H. D. Hammond), pp. 401-426. New York Botanical Garden, New York.
- Dawkins, H. C. (1958) The management of natural tropical high forest with special reference to Uganda. Imperial Forest Institute, University of Oxford, Oxford.
- Dayanandan, S., Ashton, P. S., Williams, S. M. & Primack, R. B. (1999) Phylogeny of the tropical tree family Dipterocarpaceae based on nucleotide sequences of the chloroplast *rbcL* gene. *American Journal of Botany*, 86, 1182-1190.
- de Barros, P. L. C. (1986) Estudo fitosociológico de uma floresta tropical úmida no planalto de Curuá-Una, Amazônia brasileira. Ph.D. Thesis, Universidade Federal do Paraná, Curitiba.
- de Castro, A. (1980) Essai de classification des arbres tropicaux selon leur capacité de réiteration. *Biotropica*, 12, 187-194.
- de Zeeuw, C. (1977) Pakaraimoideae, Dipterocarpaceae of the Western hemisphere. III. Stem anatomy. *Taxon*, 26, 368-380.

- del Valle, J. I. (1979) Rendimiento y crecimiento de *Cupressus lusitanica* en Antioquia, Colombia. *Crónica Forestal y del Medio Ambiente*, 1, 1-43.
- del Valle, J. I. (1995) Evaluación del crecimiento diamétrico de árboles de humedales forestales del pacífico colombiano. *Interciencia*, 20, 273-282.
- del Valle, J. I. (1996a) Los bosques de guandal del delta del río Patía. *Revista de la Academia Colombiana de Ciencias Exactas Físicas y Naturales*, 20, 475-489.
- del Valle, J. I. (1996b) Prácticas tradicionales de producción y ordenamiento territorial. In: *Renacientes del guandal: Grupos negros de los ríos Satinga y Sanquianga* (eds J. I. del Valle & E. Restrepo), pp. 443-473. Universidad Nacional de Colombia, Bogotá.
- del Valle, J. I. (1998a) Compatibilización del crecimiento orgánico, estructura poblacional y mortalidad: aplicación para el árbol tropical *Otoba gracilipes*. I Congreso Latinoamericano IUFRO. El manejo sustentable de los recursos forestales: desafío del siglo XXI. IUFRO, Valdivia, Chile.
- del Valle, J. I. (1998b) Efectos del raleo en el crecimiento diamétrico de los bosques de *Camposperma* de Colombia. *Crónica Forestal y del Medio Ambiente*, 13, 89-103.
- del Valle, J. I. (1999) Mortalidad, sobrevivencia y vida media del árbol tropical *Camposperma panamensis*. *Crónica Forestal y del Medio Ambiente*, 14, 5-18.
- Denslow, J. S. (1987) Tropical rainforest gaps and tree species diversity. *Annual Review of Ecology and Systematics*, 18, 431-451.
- Domínguez, C. A. (1987) Colombia y la Panamazonia. En: *Colombia amazónica* (eds M. Jimeno, S. Cárdenas, A. M. Sierra, P. Leyva & A. Guarnizo), pp. 31-50. Universidad Nacional de Colombia, Fondo para la Protección del Medio Ambiente José Celestino Mutis FEN, Bogotá.
- Drénou, C. (1994) Approche architecturale de la sénescence des arbres: le cas de quelques angiospermes tempérées et tropicales. Ph.D. Thesis, Université Montpellier II, Sciences et Techniques du Languedoc, Montpellier.

- Dubois, J. (1980) Curso multinacional de capacitación en silvicultura y manejo de bosques amazónicos. IICA, Medellín.
- Duivenvoorden, J. F. (1994) Vascular plant species counts in the rain forests of the middle Caquetá area, Colombian Amazonia. *Biodiversity and Conservation*, 3, 685-715.
- Duivenvoorden, J. F. (1995) Tree species composition and rain forest-environmental relationships in the middle Caquetá area, Colombia, NW Amazonia. *Vegetatio*, 120, 91-113.
- Duivenvoorden, J. F. (1996) Patterns of tree species richness in rain forests of the middle Caquetá area, Colombia, NW Amazonia. *Biotropica*, 28, 142-158.
- Duivenvoorden, J.F. & Duque. A.J. (2010) Composition and diversity of northwestern Amazonian forests in a geoeological context. In: *Amazonia - Landscape and species evolution: a look in the past* (eds C. Hoorn & F. Wesselingh), pp. 360-372. Wiley-Blackwell, Chichester.
- Duivenvoorden, J. F. & Lips, J. M. (1990) Levantamiento ecológico de la cuenca del medio Caquetá: Avance de investigación para la comisión evaluadora. Fundación Tropenbos-Colombia.
- Duivenvoorden, J. F. & Lips, J. M. (1993) Ecología del paisaje del Medio Caquetá: Memoria explicativa de los mapas. Fundación Tropenbos-Colombia, Bogotá.
- Duivenvoorden, J. F. & Lips, J. M. (1995) A land-ecological study of soils, vegetation, and plant diversity in Colombian Amazonia. Tropenbos Foundation, Wageningen.
- Duivenvoorden, J. F., Balslev, H., Cavalier, J., Grández, C., Tuomisto, H. & Valencia, R. (2001) Evaluación de recursos vegetales no maderables en la Amazonia noroccidental. Institute for Biodiversity and Ecosystem Dynamics, Universiteit van Amsterdam, Amsterdam.
- Duivenvoorden, J. F., Lips, J., Palacios, P. A. & Saldarriaga, J. G. (1988) Levantamiento ecológico de parte de la cuenca del medio Caquetá en la Amazonia colombiana. *Colombia Amazónica*, 3, 7-38.
- Duque, A. (2004) Plant diversity scaled by growth forms along spatial and environmental gradients: A study in the rain forest of NW Amazonia. Tropenbos International, Wageningen.

- Echeverri, A. (1993) Formas de crecimiento, producción de hojas y distribución de palmas y *Phenakospermum guianense* (L. C. Rich.) Enlicher ex Miquel (Strelitziaceae) en una cronosecuencia sobre Terrazas Bajas del Río Caquetá en la Amazonia colombiana. Tesis B.Sc. (Biología), Universidad de Antioquia, Medellín.
- Echeverri, A. (1997) Análisis arquitectónico de *Quercus humboldtii* (roble) en Antioquia, Colombia. Universidad de Antioquia, COLCIENCIAS, Medellín.
- Echeverri, S. V. & López, E. W. (2000) Dinámica de un bosque de várzea en la Amazonia colombiana. Tesis B.Sc. (Ingeniería Forestal), Universidad Nacional de Colombia sede Medellín, Medellín.
- Édelin, C. (1977) Image de l'architecture des conifères. Thèse Spécialité M.Sc., Université Montpellier II, Sciencés et Techniques du Languedoc, Montpellier.
- Édelin, C. (1984) L'architecture monopodiale: L'exemple de quelques arbres d'Asie tropicale. Ph.D. Thesis, Université Montpellier II, Sciencés et Techniques du Languedoc, Montpellier.
- Édelin, C. (1991) Nouvelles données sur l'architecture des arbres sympodiaux: Le concept de plan d'organisation. In: L'arbre: Biologie et developpement (ed. C. Édelin), pp. 127-154. Institut de Botanique, Université Montpellier II, Montpellier.
- Eden, M. J., McGregor, D. F. M. & Morelo, J. A. (1982) Geomorphology of the Middle Caquetá basin of Eastern Colombia. Zeitschrift für Geomorphologie, 26, 343-364.
- Erdtman, G. (1952) An introduction to Palynology I. Pollen morphology and plant taxonomy. Angiosperms. Almqvist and Wiksell, Stockholm.
- FAO (1988) FAO/UNESCO soil map of the world, revised legend, with corrections. FAO, Rome.
- FAO (2001) Global forest resource assessment: 2000 main report. FAO, Rome.
- Fearnside, P. M. & Laurance, W. F. (2003) Comment on 'Determination of deforestation rates of the world's humid tropical forests'. Science, 299, 1015a.

- Felfili, J. M. (1995) Growth, recruitment and mortality in the Gamma gallery forest in Central Brazil, over a six -year period (1985-1991). *Journal of Tropical Ecology*, 11, 67-83.
- Foster, R. B. (1990) The floristic composition of the río Manu floodplain forest. In: *Four Neotropical rainforests.* (ed A. H. Gentry), pp. 99-111. Yale University Press, New Haven.
- Foster, R. B. & Hubbell, S. P. (1990) The floristic composition of Barro Colorado Island forest. In: *Four Neotropical rainforests* (ed. A. H. Gentry), pp. 85-98. Yale University Press, New Haven.
- Foster, M. J. and Terborgh, J. (1998) Impact of a rare storm event on an Amazonian forest. *Biotropica*, 30, 470-474.
- Franklin, J. F., Shugart, H. H. & Harmon, M. E. (1987) The death as an ecological process. *BioScience*, 37, 550-556.
- Gale, N. (1997) Modes of tree death in four tropical forests. Ph.D. Thesis, University of Aarhus, Aarhus.
- Gale, N. & Barfod, A. S. (1999) Canopy tree mode of death in a Western Ecuadorian rain forest. *Journal of Tropical Ecology*, 15, 416-436.
- Galeano, G. (1992) *Las palmas de la región de Araracuara.* Fundación Tropenbos-Colombia, Bogotá.
- Gentry, A. H. (1982) Neotropical floristic diversity: Phyto-geographical connections between Central and South America, Pleistocene climatic fluctuations, or an accident of the Andean orogeny? *Annals of Missouri Botanical Garden* 69, 557-593.
- Gentry, A. H. (1986) Species richness and floristic composition of Chocó region plant communities. *Caldasia*, 15, 71-92.
- Gentry, A. H. (1988a) Changes in plant community diversity and floristic composition on environmental and geographical gradients. *Annals of the Missouri Botanical Garden*, 75, 1-34.
- Gentry, A. H. (1988b) Tree species richness of upper Amazonian forests. *Proceedings of National Academy of Science*, 85, 156-159.
- Gentry, A. H. (1990a) Floristic similarities and differences between southern Central America and upper and central Amazonia. In: *Four Neotropical Rainforests* (ed. A. H. Gentry), pp. 141-157. Yale University Press, New Haven.

- Gentry, A. H. (1990b) Speciation in tropical forests. In: Tropical Forests (eds L. B. Holm-Nielsen, I. C. Nielsen & H. Balslev), pp. 113-134. Academic Press, New York.
- Gentry, A. H. (1991a) The distribution and evolution of climbing plants. In: The biology of vines (eds F. E. Putz & H. A. Mooney), pp. 3-42. Cambridge University Press, Cambridge.
- Gentry, A. H. (1991b) La región amazónica. In: Selva húmeda de Colombia (eds G. Villegas & C. Hurtado), pp. 53-64. Villegas Editores, Bogotá.
- Gentry, A. H. (1991c) La región del Chocó. In: Selva húmeda de Colombia (eds G. Villegas & C. Hurtado), pp. 41-48. Villegas Editores, Bogotá.
- Gentry, A. H. (1992) Tropical forest biodiversity: Distributional patterns and their conservational significance. *Oikos*, 63, 19-28.
- Gentry, A. H. (1993) Overview of the Peruvian flora. In: Catalogue of the flowering plants and gymnosperms of Perú (eds L. Brako & J. L. Zarucchi), pp. xxix-xxxviii. Missouri Botanical Garden, Saint Louis.
- Gentry, A. H. & Emmons, L. H. (1987) Geographical variation in fertility, phenology, and composition of the understory of Neotropical forests. *Biotropica*, 19, 216-227.
- Gentry, A. H. & Ortiz, R. (1993) Patrones de composición florística en la Amazonia Peruana. In: Amazonia peruana: Vegetación húmeda tropical en el llano subandino (eds R. Kalliola, M. Puhakka & W. Danjoy), pp. 155-166. Proyecto Amazonia, Universidad de Turku (PAUT) & Oficina Nacional de Evaluación de Recursos Naturales (ONERN), Jyväskylä, Finlandia.
- Gentry, A. H. & Terborgh, J. (1990) Composition and dynamics of the Cocha Cashu "mature" floodplain forest. In: Four Neotropical rainforests (ed. A. H. Gentry), pp. 542-564. Yale University Press, New Haven.
- Giannasi, D. E. & Niklas, K. J. (1977) Pakaraimoideae, Dipterocarpaceae of the Western hemisphere. IV. Phytochemistry. *Taxon*, 26, 380-385.
- González, H. (1994) Análisis del crecimiento en condiciones naturales de *Prioria copaiifera* Grisebach por medio de modelos matemáticos.

- Tesis M.Sc (Silvicultura y Manejo de Bosques), Universidad Nacional de Colombia sede Medellín Medellín.
- González, H. (1995) Análisis del crecimiento diamétrico de *Prioria copaifera* en condiciones naturales por medio de un modelo matemático determinístico. *Crónica Forestal y del Medio Ambiente*, 10, 101-120.
- González, H., Gómez, H. D. & Arteaga, F. J. (1991) Aspectos estructurales de un bosque de cativo en la región del bajo Atrato, Colombia. *Revista de la Facultad Nacional de Agronomía (Medellín)*, 44, 3-50.
- Gottwald, H. & Parameswaran, N. (1966) Das sekundäre Xylem der Familie Dipterocarpaceae. *Botanische Jahrbücher für Systematik, Pflanzengeschichte und Pflanzengeographie*, 85, 410-508.
- Grant, V. (1989) Especiación vegetal. Noriega Editores, México.
- Guerin, P. (1906) Cellules a mucilage des Dipterocarpacees. *Bulletin de la Société Botanique de France*, 53, 443-451.
- Hall, P., Ashton, P. S., Condit, R., Manokaran, N. & Hubbell, S. P. (1998) Signal and noise in sampling tropical forest structure and dynamics. In: *Forest biodiversity research, monitoring and modelling: conceptual background and Old World case studies* (eds F. Dallmeier & J. Comiskey), pp. 63-77. UNESCO & The Parthenon Group, Paris.
- Hallé, F. (1995) Canopy architecture in tropical trees: A pictorial approach. In: *Forest canopies* (eds M. D. Lowman & N. M. Nadkarni), pp. 27-44. Academic Press, San Diego.
- Hallé, F. & Oldeman, R. A. A. (1970) *Essai sur l'architecture et la dynamique de croissance des arbres tropicaux*. Masson, Paris.
- Hallé, F., Oldeman, R. A. A. & Tomlinson, P. B. (1978) *Tropical trees and forests: An architectural analysis*. Springer, Berlin.
- Hammel, B. (1990) The distribution of diversity among families, genera, and habit types in the La Selva flora. In: *Four Neotropical rainforests* (ed. A. H. Gentry), pp. 75-84. Yale University Press, New Haven.
- Hartshorn, G. S. (1990a) Gap-phase dynamics and tropical tree species richness. In: *Tropical forests: Botanical dynamics, speciation and*

- diversity (eds L. B. Holm-Nielsen, I. C. Nielsen & H. Balslev), pp. 65-73. Academic Press, London.
- Hartshorn, G. S. (1990b) An overview of Neotropical forest dynamics. In: Four Neotropical rainforests (ed. A. H. Gentry), pp. 585-600. Yale University Press, New Haven.
- Hegarty, E. & Caballé, G. (1991) Distribution and abundance of vines in forest communities. In: The biology of vines (eds F. E. Putz & H. A. Mooney), pp. 305-327. Cambridge University Press, Cambridge.
- Herben, T. (1996) Permanent plots as tools for plant community ecology. *Journal of Vegetation Science*, 7, 195-202.
- Herrera, M. M. (1994) La familia Myristicaceae: Posibilidades de uso múltiple y sostenido en bosques húmedos tropicales de Colombia. Tesis B.Sc. (Biología), Universidad Nacional de Colombia, Bogotá.
- Holdridge, L. R. (1982) Ecología basada en zonas de vida. Instituto Interamericano de Cooperación para la Agricultura, IICA, San José (Costa Rica).
- Holdridge, L. R., Grenke, W. C., Hatheway, W. H., Liang, T. & Tosi, J. A. (1971) Forest environments in tropical life zones: A pilot study. Pergamon Press, Oxford.
- Holmgren, M., Scheffer, M., Ezcurra, E., Gutiérrez, J. R. & Mohren, G. M. J. (2001) El Niño effects on the dynamics of terrestrial ecosystems. *Trends in Ecology and Evolution*, 16, 89-94.
- Hoorn, C. (1990) Evolución de los ambientes sedimentarios durante el Terciario y el Cuaternario en la Amazonia colombiana. *Colombia Amazónica*, 4, 97-126.
- Hoorn, C. (1994) Miocene palynostratigraphy and paleoenvironments of Northwestern Amazonia: Evidence for marine incursions and the influence of Andean tectonics. Ph.D. Thesis, Universiteit van Amsterdam, Amsterdam.
- Hoorn, C. & Wesselingh, F. (eds) (2010) Amazonia - Landscape and species evolution: a look in the past. Wiley-Blackwell, Chichester.
- Houghton, J. T., Ding, Y., Griggs, D. J., Noguer, M., van der Linden, P. J., Dai, X., Maskell, K. & Johnson, C. A. (2001) The scientific basis. IPCC Intergovernmental Panel on Climate Change. Contribution

- of Working Group 1 to the IPCC, third Assessment. Cambridge University Press, Cambridge.
- Hubbell, S. P. (2001) The unified neutral theory of biodiversity and biogeography. Princeton University Press, Princeton.
- Hubbell, S. P. (2004) Two decades of research on the BCI forest dynamics plot. *Tropical forest diversity and dynamism: Findings from a large-scale plot network.* (eds E. C. Losos & E. G. Leigh), pp. 8-30. Chicago University Press. 645 p., Chicago.
- Hubbell, S. P. & Foster, R. B. (1986) Canopy gaps and the dynamics of a Neotropical forest. In: *Plant ecology* (ed. M. J. Crawley), pp. 77-95. Blackwell Scientific Publications, Oxford.
- Hubbell, S. P. & Foster, R. B. (1990) Structure, dynamics and equilibrium status of old-growth forest on Barro Colorado Island. In: *Four Neotropical Forests* (ed. A. H. Gentry), pp. 522-541. Yale University Press, New Haven.
- Huston, M. (1980) Soil nutrients and tree species richness in Costa-Rican forests. *Journal of Biogeography*, 7, 147-157.
- Irion, G. (1990) Quaternary geological history of the Amazon lowlands. In: *Tropical forests: Botanical dynamics, speciation and diversity* (eds L. B. Holm-Nielsen, I. C. Nielsen & H. Balslev), pp. 23-34. Academic Press, London.
- Jiménez, E. M. (2000) *Arquitectura de tres especies de Myristicaceae en dos bosques de la región de Araracuara (Amazonia colombiana).* Tesis B.Sc. (Ingeniería Forestal), Universidad Nacional de Colombia, Medellín.
- Jonkers, W. B. J. (1987) Vegetation structure, logging damage and silviculture in a tropical rain forest in Suriname. Agricultural University of Wageningen, Wageningen.
- Junk, W. J. (1984) Ecology of the várzea, floodplain of Amazonian whitewater rivers. *The Amazon: Limnology and landscape ecology of a mighty tropical river and its basin.* (ed H. Sioli), pp. 215-243. Junk Publishers, Dordrecht
- Junk, W. J. (1990) Flood tolerance and tree distribution in central Amazonian floodplains. In: *Tropical forests: Botanical dynamics, speciation and diversity* (eds L. B. Holm-Nielsen, I. C. Nielsen & H. Balslev), pp. 47-64. Academic Press, London.

- Junk, W. J. & Furch, K. (1985) The physical and chemical properties of Amazonian waters. In: Amazonia (eds G. T. Prance & T. Lovejoy), pp. 3-17. Pergamon Press, Oxford.
- Keeland, B. D. & Sharitz, R. R. (1997) The effects of water-level fluctuations on weekly tree growth in a Southeastern USA Swamp. *American Journal of Botany*, 84, 131-139.
- Kenneth, L. (1995) Forest dynamics, differential mortality and variable recruitment probabilities. *Journal of Vegetation Science*, 6, 191-204.
- Köppen, W. (1936) Das geographische System der Klimate. *Handbuch der Klimatologie*. (eds W. Köppen & R. Geiger), pp. 1-44. Verlag Gebrüder Borntraeger, Berlin.
- Korning, J. & Balslev, H. (1994) Growth and mortality of trees in Amazonian tropical rain forests in Ecuador. *Journal of Vegetation Science*, 4, 77-86.
- Korning, J., Thomsen, K. & Ollgaard, B. (1991) Composition and structure of a species rich Amazonian rain forest obtained by two different sample methods. *Nordic Journal of Botany*, 11, 103-110.
- Krebs, C. J. (1989) *Ecological methodology*. Harper & Row Publishers, New York.
- Kubo, T., Kohyama, T., Potts, M. D. & Ashton, P. S. (2000) Mortality rate estimation when inter-census intervals vary. *Journal of Tropical Ecology*, 16, 753-756.
- la Rotta, C. (1982) Observaciones etnobotánicas de la comunidad Andoque de la Amazonia colombiana. *Colombia Amazónica*, 1, 53-67.
- la Rotta, C., Miraña, P., Miraña, M., Miraña, B., Miraña, M. & Yucuna, N. (1989) Especies utilizadas por la comunidad Miraña: Estudio etnobotánico. World Wildlife Fund, Fondo para la protección del Medio Ambiente José Celestino Mutis FEN, Bogotá.
- Laurance, W. F., Ferreira, L. V., Rankin-de Moreno, J. M. & Hutchings, R. (1998) Influence of plot shape on estimates of tree diversity and community composition in central Amazonia. *Biotropica*, 30, 662-665.
- Laurance, W. F., Oliveira, A. A., Laurance, S. G., Condit, R., Nascimento, H. E. M., Sánchez-Thorin, A. C., Lovejoy, T., Andrade, A.,

- D'Angelo, S., Ribeiro, J. & Dick, C. W. (2004) Pervasive alteration of tree communities in undisturbed Amazonian forests. *Nature*, 428, 171-175.
- Lema, Á. (1995) *Dasometría: Algunas aproximaciones estadísticas a la medición forestal*. Centro de Publicaciones Universidad Nacional de Colombia sede Medellín, Medellín.
- Lema, Á. (2002) *Inventarios forestales: Estadística y planificación*. Universidad Nacional de Colombia sede Medellín, Medellín.
- Lewis, S. L., Phillips, O. L., Baker, P., Lloyd, J., Malhi, Y., Almeida, S., Higuchi, N., Laurance, W. F., Neill, D. A., Silva, J. N. M., Terborgh, J., Torres Lezama, A., Vásquez-Martínez, R., Brown, S., Chave, J., Kuebler, C., Núñez Vargas, P. & Vinceti, B. (2004a) Concerted changes in tropical forest structure and dynamics: evidence from 50 South American long-term plots. *Philosophical Transactions of the Royal Society, London, Series B*, 359, 421-436.
- Lewis, S. L., Phillips, O. L., Sheil, D., Vinceti, B., Baker, T. R., Brown, S., Graham, A. W., Higuchi, N., Hilbert, D. W., Laurance, W. F., Lejoly, J., Malhi, Y., Monteagudo, A., Núñez Vargas, P., Sonké, B., Supardi M.N., M., Terborgh, J. W. & Vásquez Martínez, R. (2004b) Tropical forest tree mortality, recruitment and turnover rates: calculation, interpretation and comparison when census intervals vary. *Journal of Ecology*, 92, 929-944.
- Lieberman, D., Hartshorn, G. S., Lieberman, M. & Peralta, R. (1990) Forests dynamics at La Selva biological station. In: *Four Neotropical rainforests* (ed. A. H. Gentry), pp. 509-521. Yale University Press, New Heaven.
- Lieberman, D., Lieberman, M., Peralta, R. & Hartshorn, G. S. (1985) Mortality patterns and stand turnover rates in a wet tropical forest in Costa Rica. *Journal of Ecology*, 73, 915-924.
- Lieberman, M. & Lieberman, D. (1985) Simulation of growth curves from periodic increment data. *Ecology*, 66, 632-635.
- Lips, J. M. & Duivenvoorden, J. F. (1994) Geomorphic and lithostratigraphic evidence of Pleistocene climatic change in Amazonia: new data from the Middle Caquetá area, Colombia. *Geo-Eco-Trop*, 16, 21-47.

- Lips, J. M. & Duivenvoorden, J. F. (1996) Fine litter input to terrestrial humus forms in Colombian Amazonia. *Oecologia*, 108, 138-150.
- Londoño, A. C. (1993) Análisis estructural de dos bosques asociados a unidades fisiográficas contrastantes en la región de Araracuara (Amazonia colombiana). Tesis B.Sc. (Ingeniería Forestal), Universidad Nacional de Colombia, sede Medellín, Medellín.
- Londoño, A. C. & Álvarez, E. (1991) Resultados preliminares sobre la estructura de bosques de tierra firme y de várzea en Peña Roja. Fundación Tropenbos-Colombia, Bogotá.
- Londoño, A. C. & Álvarez, E. (1993) Reporte preliminar biomasa. Fundación Tropenbos-Colombia, Bogotá.
- Londoño, A. C. & Álvarez, E. (1997) Composición florística de dos bosques (tierra firme y várzea) en la región de Araracuara, Amazonia colombiana. *Caldasia*, 19, 431-463.
- Londoño, A. C. & Jiménez, E. M. (1999) Efecto del tiempo entre los censos sobre la estimación de las tasas anuales de mortalidad y de reclutamiento de árboles (períodos de 1, 4 y 5 años). *Crónica Forestal y del Medio Ambiente*, 14, 41-57.
- Londoño, A. C., Álvarez, E., Forero, E. & Morton, C. (1995) A new genus and species of Dipterocarpaceae from the Neotropics: I. Introduction, taxonomy, ecology and distribution. *Brittonia*, 47, 225-236.
- Losos, E. C. & Leigh, E. G. (2004) Forest dynamics and dynamism: Findings from a network of large-scale tropical forest plots. The University of Chicago Press, Chicago.
- Loubry, D. (1994) Déterminisme du comportement phénologique des arbres en forêt tropicale humide de Guyane française (5° lat. N.). Ph.D. Thesis, Université de Paris VI. 2v., Paris.
- Loup, C. (1994) Essai sur le déterminisme de la variabilité architecturale des arbres: Le cas de quelques espèces tropicales. Ph.D. Thesis, Université Montpellier II, Montpellier.
- Lugo, A. & Scatena, F. N. (1996) Background and catastrophic tree mortality in tropical moist, wet, and rain forests. *Biotropica*, 28, 585-599.
- Mabberley, D. J. (1990) The plant book: A portable dictionary of the higher plants. Cambridge University Press, Cambridge.

- Mabberley, D. J. (1992) *Tropical rain forest ecology*. Chapman and Hall, New York.
- Madrinán, S. (1996) Richard Spruce's pioneering work on tree architecture. In: Richard Spruce (1817-1893): botanist and explorer (eds M. R. D. Seaward & S. M. D. FitzGerald), pp. 215-226. The Royal Botanic Gardens, Kew.
- Maguire, B. (1977) Pakaraimoideae, Dipterocarpaceae from the Western hemisphere. I. Introduction. *Taxon*, 26, 341-342.
- Maguire, B. & Ashton, P. S. (1977) Pakaraimoideae, Dipterocarpaceae from the Western hemisphere. II. Systematic, geographic and phyletic considerations. *Taxon*, 26, 343-368.
- Magurran, A. (1988) *Ecological diversity and its measurement*. Princeton University Press, Princeton.
- Malhi, Y. & Phillips, O. L. (2004) Tropical forest and global atmospheric change: a synthesis. *Philosophical Transactions of the Royal Society of London, Series B*, 395, 549-555.
- Malhi, Y., Phillips, O. L., Lloyd, J., Baker, T., Wright, J., Almeida, S., Arroyo, L., Frederiksen, T., Grace, J., Higuchi, N., Killeen, T., Laurance, W. F., Leão, C., Lewis, S., Meir, P., Monteagudo, A., Núñez Vargas, P., Panfil, S., Patiño, S., Pitman, N., Quesada, C. A., Rudas, A., Salomão, R., Saleska, S., Silva, N., Silveira, M., Sombroek, W. G., Valencia, R., Vásquez Martines, R., Vieira, I. C. G. & Vinceti, B. (2002) An international network to monitor the structure, composition and dynamics of Amazonian forests (Rainfor). *Journal of Vegetation Science*, 13, 439-450.
- Malhi, Y., Wood, D., Baker, T. R., Wright, J., Phillips, O. L., Cochrane, T., Meir, P., Chave, J., Almeida, S., Arroyo, L., Higuchi, N., Killeen, T. J., Laurance, S. G., Laurance, W. F., Lewis, S. L., Monteagudo, A., Neill, D. A., Vargas, P. N., Pitman, N. C. A., Quesada, C. A., Salomao, R., Silva, J. N. M., Lezama, A. T., Terborgh, J., Martinez, R. V. & Vinceti, B. (2006) The regional variation of aboveground live biomass in old-growth Amazonian forests. *Global Change Biology*, 12, 1107-1138.
- Manokaran, N. & Swaine, M. D. (1994) Population dynamics of trees in Dipterocarp forests of Peninsular Malaysia. *Malayan Forest Records* 40, Forest Research Institute Malaysia, Kuala Lumpur.

- Martínez, X. & Galeano, G. (1994) Los platanillos del Medio Caquetá: Las Heliconias y el *Phenakospermum*. Fundación Tropenbos-Colombia, Bogotá.
- Matelson, T. J., Nadkarni, N. M. & Solano, R. (1995) Tree damage and annual mortality in a montane forest in Monteverde, Costa Rica. *Biotropica*, 27, 441-447.
- Matteucci, S. D. & Colma, A. (1982) Metodología para el estudio de la vegetación. Secretaría de la Organización de los Estados Americanos (OEA), Washington.
- Maury, G., Muller, J. & Lugardon, B. (1975) Notes on the morphology and fine structure of the exine of some pollen types in Dipterocarpaceae. *Review of Palaeobotany and Palynology*, 19, 241-289.
- Mayle, F. E., Beerling, D. J., Gosling, W. J. & Bush, M. B. (2004) Responses of Amazonian ecosystems to climatic and atmospheric carbon dioxide changes since the Last Glacial Maximum. *Philosophical Transactions of the Royal Society of London, Series B*, 359, 499-514.
- Missouri-Botanical-Garden (2001) WWW Tropicos. VAST (VAScular Tropicos) nomenclatural database.
- Mora, S. (ed.) (2003) Early inhabitants of the Amazonian tropical rain forest: A study of human and environmental dynamics. *Latin American Archaeology Reports 3*, University of Pittsburgh, Pittsburgh.
- Mora, S., Herrera, L. F., Cavelier, I. & Rodríguez, C. (1991). Plantas cultivadas, suelos antrópicos y estabilidad: Informe preliminar sobre la arqueología de Araracuara, Amazonia colombiana. *Latin American Archaeology Reports 2*, University of Pittsburgh, Pittsburgh.
- Mori, S. A., Boom, B. M., Carvalino, A. M. & dos Santos, T. S. (1983) Ecological importance of Myrtaceae in an Eastern Brazilian wet forest. *Biotropica*, 15, 68-70.
- Morton, C. M. (1995) A new genus and species of Dipterocarpaceae from the Neotropics. II. Stem anatomy. *Brittonia*, 47, 237-247.
- Morton, C. M., Dayanandan, S. & Dissanayake, D. (1999) Phylogeny and biosystematics of *Pseudomonotes* (Dipterocarpaceae) based on

- molecular and morfological data. *Plant Systematics and Evolution*, 216, 197-205.
- Murillo, J. C. & Franco, P. (1995) Las euforbiáceas de la región de Araracuara. Fundación Tropenbos Colombia, Bogotá.
- Negrelle, R. R. B. (1995) Sprouting after uprooting of canopy trees in the Atlantic rain forest of Brazil. *Biotropica*, 27, 448-454.
- Nelson, B. W., Ferreira, C. A. C., da Silva, M. F. & Kawasaki, M. L. (1990) Endemism centers, refugia and botanial collection density in Brazilian Amazonia. *Nature*, 345, 714-716.
- Nelson, B. W., Kapos, V., Adams, J. B., Oliveira, W. J., Braun, O. P. G. & do Amaral, I. L. (1994) Forest disturbance by large blowdowns in the Brazilian Amazon. *Ecology*, 75, 853-858.
- Nilsson, S. & Praglowski, J. (1992) *Erdtman's handbook of palynology*. Munksgaard International Publishers, Copenhagen.
- Oldeman, R. A. A. (1974) *L'architecture de la forêt Guyanaise*. ORSTOM, Paris.
- Oldeman, R. A. A. (1990a) Forest ecosystems and their components: An introduction. In: *Forest components* (eds R. A. A. Oldeman, P. Schmidt & E. J. M. Arnolds), pp. 90-96. Wageningen Agricultural University, Wageningen
- Oldeman, R. A. A. (1990b) *Forests: Elements of silvology*. Springer, Berlin.
- Oldeman, R. A. A. & Hallé, F. (1980) Sobre los ejes mixtos plagio-ortótropos en algunos árboles tropicales. *Miscellaneous Papers*, 19, 281-287.
- Oldeman, R. A. A. & Teller, A. (1989) Unification of European forest pattern research. Workshop on Forest Ecosystem Research Network, FERN, European Science Foundation, ESF, 24-26 abril, 1989, Estrasburgo, Francia. Pudoc, Wageningen.
- Oldeman, R. A. A., Vester, H. F. M., Londoño, A. C. & Callejas, R. (2006) *Guía para el estudio de la arquitectura arbórea*. Unpublished manuscript, Medellín.
- Orians, G. H. (1982) The influence of tree-falls in tropical forests in the species richness. *Tropical Ecology*, 23, 255-279.

- Ordóñez, N. (1990) Estudio detallado de suelos: Plano aluvial del río Caquetá, sitio de monitoreo número 2. Fundación Tropenbos-Colombia, Bogotá.
- Orrego, S. A., del Valle, J. I. & Moreno, F. H. (2003) Medición de la captura de carbono en ecosistemas forestales tropicales de Colombia: Contribuciones para la mitigación del cambio climático. Departamento de Ciencias Forestales, Universidad Nacional de Colombia sede Medellín, Centro Andino para la Economía en el Medio Ambiente, Bogotá.
- Padoch, C., Ayres, J. M., Pinedo-Vásquez, M. & Henderson, A. (1999) *Várzea: Diversity, development, and conservation of Amazonia's whitewater floodplains*. Advances in Economic Botany 13. New York Botanical Garden, Bronx.
- Parrado, A. (2005) Fruit availability and seed dispersal in tierra firme rain forests of Colombian Amazonia. Tropenbos Foundation, Wageningen
- Paz-Miño, G., Balslev, H. & Valencia, R. (1991) Aspectos etnobotánicos de las lianas utilizadas por los indígenas Siona-Secoya del Ecuador. In: *Las plantas y el hombre* (ed. M. H. B. P. Ríos), pp. 105-118. Ediciones Abya-Yala, Quito.
- Philip, M. S. (1994) *Measuring trees and forests*. Centre for Agricultural and Bioscience (CAB) International, Cambridge.
- Phillips, O. L. (1998a). Increasing tree turnover in tropical forests as measured in permanent plots. In: *Forest biodiversity research, monitoring and modeling: conceptual background and old world cases* (eds F. Dallmeier & J. A. Comiskey), pp. 221-245. *Man and the Biosphere Series 20*, Unesco and the Parthenon Group, Paris.
- Phillips, O. L. (1998b). Tree mortality and collecting botanical vouchers in tropical forests. *Biotropica*, 30, 298-305.
- Phillips, O. L. & Baker, T. (2002) *Field manual for plot establishment and re-measurement*. Rainfor, Amazon Forest Inventory Network, Leeds.
- Phillips, O. L., Baker, T. R., Arroyo, L., Higuchi, N., Killeen, T. J., Laurance, W. F., Lewis, S. L., Lloyd, J., Malhi, Y., Monteagudo, A., Neill, D. A., Núñez-Vargas, P., Silva, J. N. S., Terborgh, J., Comiskey, J. A., Czimcsik, C. I., Di Fiore, A., Erwin, T., Kuebler,

- C., Laurance, S. G., Nascimento, H. E. M., Olivier, J., Palacios, W., Patiño, S., Pitman, N. C. A., Quesada, C. A., Saldias, M., Torres Lezama, A. & Vinceti, B. (2004) Pattern and process in Amazon tree turnover, 1976-2001. *Philosophical Transactions of the Royal Society of London, Series B*, 359, 381-407.
- Phillips, O. L., Hall, P., Gentry, A. H., Sawyer, S. A. & Vásquez, R. (1994) Dynamics and species richness of tropical rain forests. *Proceedings of National Academy of Science*, 91, 2805-2809.
- Phillips, O. L., Malhi, Y., Higuchi, N., Laurance, W. F., Núñez, P., Vásquez, M., Laurance, S., Ferreira, L., Stern, M., Brown, S. & Grace, J. (1998) Changes in the carbon balance of tropical forest: Evidence from long-term plots. *Science*, 282, 439-442.
- Pielou, E. C. (1975) *Ecological diversity*. John Wiley & Sons, New York.
- Pires, J. M. & Prance, G. T. (1985) The vegetation types of the Brazilian Amazon. In: *Amazonia* (eds G. T. Prance & T. E. Lovejoy), pp. 109-145. Pergamon Press, Oxford.
- Pitman, N. C. A., Terborgh, J. W., Silman, M. S., Núñez V., P., Neill, D. A., Cerón, C. E., Palacios, W. A. & Aulestias, M. (2001) Dominance and distribution of tree species in upper Amazonian Terra Firme forests. *Ecology*, 82, 2102-2117.
- Poorter, L. & Weger, M. J. A. (1999) Light environment, sapling architecture, and leaf display in six rain forest tree species. *American Journal of Botany*, 86, 1464-1473.
- Poulsen, A. & Balslev, H. (1991) Abundance and cover of ground herbs in an Amazonian rain forest. *Journal of Vegetation Science*, 2, 315-322.
- Prance, G. T. (1980) A terminologia dos tipos florestais amazônicas sujeitas a inundação. *Acta Amazônica*, 10, 341-349.
- Prance, G. T. (1990) The floristic composition of the forest of Central Amazonian Brazil. In: *Four Neotropical rainforests* (ed. A. Gentry), pp. 112-140. Yale University Press, New Haven.
- PRORADAM (1979) *La Amazonia colombiana y sus recursos: Proyecto radargramétrico del Amazonas*, PRORADAM. Instituto Geográfico Agustín Codazzi, Bogotá.
- Putz, F. E., Coley, P. D., Lu, K., Montalvo, A. & Aiello, A. (1983) Uprooting and snapping of trees: structural determinants and

- ecological consequences. *Canadian Journal of Forest Research*, 13, 1011-1020.
- Putz, F. E. & Milton, K. (1983) Tree mortality rates on Barro Colorado Island. In: *The ecology of tropical forest: Seasonal rhythms and long-term changes* (eds E. G. Leigh, A. S. Rand & D. M. Windsor), pp. 95-108. Smithsonian Institution, Washington.
- Quiñones, M. (2002) Polarimetric data for tropical forest monitoring: Studies at the Colombian Amazon. Tropenbos Foundation, Wageningen
- Rankin de Merona, J. M., Hutchings, R. W. & Lovejoy, T. E. (1990) Tree mortality and recruitment over a five-year period in undisturbed rainforest of the Central Amazon. In: *Four Neotropical rainforests* (ed. A. H. Gentry), pp. 573-584. Yale University Press, New Haven.
- Rees, M., Condit, R., Crawley, M., Pacala, S. & Tilman, D. (2001) Long-Term studies of vegetation dynamics. *Science*, 293, 650-655.
- Renner, S. S., Balslev, H. & Holm-Nielsen, L. B. (1990) Flowering plants of Amazonian Ecuador: A checklist. Aarhus University Press, Aarhus.
- Ribeiro, J. E. L. S., Nelson, B. W., da Silva, M. F., Martins, L. S. S. & Hopkins, M. (1994) Reserva florestal Ducke: Diversidade e composição da flora vascular. *Acta Amazônica*, 24, 19-30.
- Richards, P. W. (1952) *The tropical rain forest: An ecological study*. Cambridge University Press, Cambridge.
- Ríos, S. (1996) Estudio de la arquitectura de la comunidad de *Prioria copaifera* Grisebach (Caesalpinaceae), en un bosque inundable de la región del Bajo Atrato, Chocó, Colombia. Tesis B.Sc. (Biología), Universidad Nacional de Colombia sede Bogotá, Bogotá.
- Rodrigues, W. A. (1982) Flora do Estado de Goiás: Coleção Rizzo. Myristicaceae. Universidad Federal de Goiás, Brasil.
- Rodríguez, C. A. (1992) Bagres, maderos y cuerderos en el bajo río Caquetá. Fundación Tropenbos-Colombia, Bogotá.
- Rodríguez, C. A. (1999) Arponeros de la trampa del sol: Sustentabilidad de la pesca comercial en el medio río Caquetá. Fundación Tropenbos-Colombia, Bogotá.

- Rodríguez, L. V. A. (1991) Biomasa y reserva de nutrientes en un ecosistema de tierra firme en la región de Araracuara. Fundación Tropenbos-Colombia, Bogotá.
- Rolim, S. G., Do Couto, H. T. Z. & De Jesus, R. M. (1999) Mortalidade e recrutamento da árvores na Floresta Atlântica em Linhares (ES). *Scientia Forestalis*, 55, 49-69.
- Rudas, A. & Prieto, A. (2005). Flórmula del Parque Nacional Natural Amacayacu, Amazonas, Colombia. *Monographs in Systematic Botany from the Missouri Botanical Garden*, 99, 1-655.
- Ruokolainen, K., Tuomisto, H., Rios, R., Torres, A. & García, M. (1994) Comparación florística de doce parcelas en bosque de tierra firme en la Amazonia peruana. *Acta Amazônica*, 24, 31-48.
- Salati, E. (1985) The climatology and hydrology of Amazonia. Amazonia. (eds G. T. Prance & T. Lovejoy), pp. 18-48. Pergamon Press. 442 p. , Oxford.
- Salo, J. & Räsänen, M. (1990) Hierarchy of landscape patterns in western Amazon. In: *Tropical forests: Botanical dynamics, speciation and diversity* (eds L. B. Holm-Nielsen, I. C. Nielsen & H. Balslev), pp. 35-45. Academic Press, London.
- Salo, J., Kalliola, R., Häkkinen, I., Mäkinen, Y., Niemelä, P., Puhakka, M. & Coley, P. D. (1986) River dynamics and the diversity of Amazon lowland forest. *Nature*, 322, 254-258.
- Sánchez, M. (1997) Catálogo preliminar comentado de la flora del Medio Caquetá (Amazonia colombiana). Fundación Tropenbos-Colombia, Bogotá.
- Sánchez, M. (2005) Use of tropical rain forest biodiversity by indigenous communities in Northwestern Amazonia. Ph.D. Thesis, Universiteit van Amsterdam, Amsterdam.
- Sánchez, M. & Miraña, P. (1991) Utilización de la vegetación arbórea en el Medio Caquetá: 1. El árbol dentro de las cunidades de la tierra, un recurso para la comunidad Miraña. *Colombia Amazónica*, 5, 69-98.
- Sanoja, E. (1992) Essai d'application de l'architecture végétale a la systématique: l'exemple de la famille des Vochisiaceae. Ph.D. Thesis, Université Montpellier II, Montpellier.

- Schultes, R. E. & Raffauf, R. F. (1990) The healing forest: Medicinal and toxic plants of the Northwest Amazonia. Dioscorides Press, Portland.
- Sheil, D. (1996) Evaluating turnover rates in tropical forests. *Science*, 268, 894.
- Sheil, D., Burslem, D. F. R. P. & Alder, D. (1995) The interpretation and misinterpretation of mortality rate measures. *Journal of Ecology*, 83, 331-333.
- Sheil, D., Jennings, S. & Savill, P. (2000) Long-term permanent plot observations of vegetation dynamics in Budongo, a Ugandan rain forest. *Journal of Tropical Ecology*, 16, 765-800.
- Sheil, D. & May, R. M. (1996) Mortality and recruitment rate evaluations in heterogeneous tropical forests. *Journal of Ecology*, 84, 91-100.
- Silver, W. L., Ostertag, R. & Lugo, A. E. (2000) The potential for Carbon sequestration through reforestation of tropical agricultural and pasture lands. *Restoration Ecology*, 8, 394-407.
- Smith, A. C. (1938a) The American species of Myristicaceae. *Brittonia*, 2, 393-510.
- Smith, A. C. (1938b) Flora of Perú. Botanical Series Field Museum of Natural History, 13, 766-784.
- Spruce, R. (1861) On the mode of branching of some Amazon trees. *Journal of the Proceedings of the Linnean Society, Botany*, 5, 3-14.
- SSS (1987) Soil Survey Staff: Key to soil taxonomy. Cornell University Press, Ithaca.
- SSS (1992) Soil Survey Staff: Key to soil taxonomy. Blacksburg Press, Virginia.
- Sterck, F. J., van der Zandt, G. J. A. W. & Oldeman, R. A. A. (1991) Architectural development of *Faidherbia albida* (Del.) A. Chev. Physiologie des arbres et arbustes en zones arides et semi-arides. Groupe d'etude de l'arbre, Paris.
- Swaine, M. D. (1990) Population dynamics of tree species in tropical forests. In: Tropical forests: Botanical dynamics, speciation and diversity (eds L. B. Holm-Nielsen, I. C. Nielsen & H. Balslev), pp. 101-110. Academic Press, London.
- Swaine, M. D. & Lieberman, D. (1987) Note on the calculation of mortality rates. *Journal of Tropical Ecology*, 3, ii-iii.

- Swaine, M. D., Lieberman, D. & Putz, F. E. (1987) The dynamics of tree populations in tropical forests: a review. *Journal of Tropical Ecology*, 3, 359-366.
- Synnott, T. J. (1979) A manual of permanent plot procedure for tropical rain forests. Commonwealth Forestry Institute, University of Oxford, Oxford.
- Synnott, T. J. (1991) Manual de procedimientos de parcelas permanentes para el bosque húmedo tropical. Instituto Tecnológico de Costa Rica, Cartago (Costa Rica).
- Taylor, D. M., Hamilton, A. C., Whyatt, J. D., Mucunguzi, P. & Bukenya-Ziraba, R. (1996) Stand dynamics in Mpanga research forest reserve, Uganda 1968-1993. *Journal of Tropical Ecology*, 12, 583-597.
- Téllez, P. (2003) Simulación del ciclo hidrológico en tres tipos de uso del suelo de la Amazonia colombiana. Tesis M.Sc., Universidad Nacional de Colombia sede Bogotá, Bogotá.
- ter Steege, H., Pitman, N. C. A., Phillips, O. L., Chave, J., Sabatier, D., Duque, A., Molino, J.-F., Prévost, M.-F., Spichiger, R., Castellanos, H., von Hildebrand, P. & Vásquez, R. (2006) Continental-scale patterns of canopy tree composition and function across Amazonia. *Nature*, 443, 444-447.
- ter Steege, H., Pitman, N., Sabatier, D., Castellanos, H., Van Der Hout, P., Daly, D. C., Silveira, M., Phillips, O., Vasquez, R., Van Andel, T., Duivenvoorden, J., Adalardo de Oliveira, A., Ek, R., Lilwah, R., Thomas, R., Van Essen, J., Baider, C., Mori, S., Terborgh, J., Nuñez, P., Mogollón, H. & Morawetz, W. (2003) A spatial model of tree α -diversity and tree density for the Amazon. *Biodiversity and Conservation*, 12, 2255-2277.
- Tobón, C. (1999) Monitoring and modelling hydrological fluxes in support of nutrient cycling studies in Amazonian rain forest ecosystems. Tropenbos Foundation, Wageningen.
- Tobón, C., Sevink, J. & Verstraten, J. M. (2004a) Litterflow chemistry and nutrient uptake from the forest floor in Northwest Amazonian forest ecosystems. *Biogeochemistry*, 69, 315-339.

- Tobón, C., Sevink, J. & Verstraten, J. M. (2004b) Solute fluxes in throughfall and stemflow in four forest ecosystems in Northwest Amazonia. *Biogeochemistry*, 70, 1-25.
- Torquebiau, E. (1979) The reiteration of the architectural model: a demographic approach to the tree. Université Montpellier II, Montpellier.
- Tropenbos-Colombia, F. (1990) Levantamiento topográfico de las áreas de monitoreo de tierra firme y várzea, en Peña Roja. Fundación Tropenbos-Colombia, Bogotá.
- Tropenbos-Colombia, F. (1994) Multi-annual Programme (1994-1999), draft for discussion. Tropenbos-Colombia Foundation, Bogotá.
- Tschinkel, H. (1972) Growth, site factors and nutritional status of *Cupressus lusitanica* Mill. (ciprés) plantations in the highlands of Colombia. Ph.D. Thesis, Universidad de Hamburgo, Hamburgo.
- Tuomisto, H. (1994) Ecological variation in the rain forests of Peruvian Amazonia: Integrating fern distribution patterns with satellite imagery. Ph.D. Thesis University of Turku, Turku.
- Tuomisto, H., Ruokolainen, K., Kalliola, R., Linna, A., Danjoy, W. & Rodríguez, Z. (1995) Dissecting Amazonian biodiversity. *Science* 269, 63-66.
- Uhl, C., Clark, D. B., Dezzeo, N. & Maquirino, P. (1988) Vegetation dynamics in Amazonian treefall gaps. *Ecology*, 69, 751-763.
- Urrego, L. E. (1991) Sucesión holocénica de un bosque de *Mauritia flexuosa* L. f. en el valle del río Caquetá, Amazonia colombiana. *Colombia Amazónica*, 5, 99-118.
- Urrego, L. E. (1997) Los bosques inundables del Medio Caquetá, Amazonia colombiana: caracterización y sucesión. Fundación Tropenbos-Colombia, Bogotá.
- Urrego, L. E. & Sánchez, M. (1997) Apuntes a la utilización y productividad potencial de la biodiversidad de los bosques inundables del Medio Caquetá. In: Los bosques inundables del Medio Caquetá: Caracterización y sucesión (ed. L. E. Urrego), pp. 257-271. Fundación Tropenbos-Colombia, Bogotá.
- Valencia, R., Balslev, H. & Paz-Miño, G. (1994) High tree alpha-diversity in Amazonian Ecuador. *Biodiversity and Conservation*, 3, 21-28.

- Vallejo, M. I., Londoño, A. C., López, R., Galeano, G., Álvarez, E. & Devia, W. (2005) Establecimiento de parcelas permanentes en bosques de Colombia. Instituto de Investigación de Recursos Biológicos Alexander von Humboldt, Bogotá.
- van der Hammen, T. & Cleef, A. M. (1992) Holocene changes of rainfall and river discharge in Northern South America and the El Niño phenomenon. *Erdkunde*, 46, 252-256.
- van der Hammen, T., Duivenvoorden, J. F., Lips, J. M., Urrego, L. E. & Espejo, N. (1992a) Late Quaternary of the middle Caquetá River area (Colombian Amazonia). *Journal of Quaternary Science*, 7, 45-55.
- van der Hammen, T., Urrego, L. E., Espejo, N., Duivenvoorden, J. F. & Lips, J. M. (1992b) Late-glacial and Holocene sedimentation and fluctuations of river water level in the Caquetá River area (Colombian Amazonia). *Journal of Quaternary Science*, 7, 57-67.
- van Dulmen, A. (2001) Pollination and phenology of flowers in the canopy of two contrasting rain forest types in Amazonia, Colombia. *Plant Ecology*, 153, 73-85.
- Veillon, J. M. (1978) Architecture of the new Caledonian species of *Araucaria*. In: *Tropical trees as living systems* (eds P. B. Tomlinson & M. H. Zimmerman), pp. 233-246. Cambridge University Press, Cambridge.
- Veillon, J. P. (1985) El crecimiento de algunos bosques naturales de Venezuela en relación con los parámetros del medioambiente. *Revista Forestal Venezolana*, 29, 5-121.
- Vester, H. F. M. (1997) The trees and the forest: the role of tree architecture in canopy development; a case study in secondary forests (Araracuara, Colombia). Ph.D. Thesis, Universiteit van Amsterdam, Amsterdam.
- Vester, H. F. M & Navarro, M. A. (2007) Fichas ecológicas, árboles maderables de Quintana Roo. Conacyt, Conabio and Ecosur, Chetumal.
- Vester, H. F. M. & Saldarriaga, J. G. (1993) Algunas características estructurales, arquitectónicas y florísticas de la sucesión secundaria sobre Terrazas Bajas en la región de Araracuara (Colombia).

Revista de la Facultad Nacional de Agronomía (Medellín), 46, 15-45.

- Vogt, K. A., Vogt, D. I. & Bloomfield, J. (1998) Analysis of some direct and indirect methods for estimating root biomass and production of forests at an ecosystem level. *Plant and Soil*, 200, 71-89.
- Watson, R. T., Noble, I. R., Bolin, B., Ravindranath, N. H., Verardo, D. J. & Dokken, D. J. (2000) IPCC Special Report, Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge.
- Whitmore, T. C. (1975) *Tropical rain forests of the far East*. Clarendon Press, Oxford.