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## Vigorous Tree Growth in a Flooded Environment: Diversity and Flood Adaptations of Amazonian Floodplain Forests

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### Abstract

In Amazonian floodplain forests, more than one thousand tree species are adapted to the prolonged periodical flooding and grow vigorously. The main growing period is the terrestrial low-water phase. In the aquatic phase, water columns reach heights which can exceed 10 metres. The trees are subjected to periods of flooding with freshwater which last up to nine months every year and which occur very regularly and predictably. Flooding causes drastic changes in gas exchange, in the bioavailability of nutrients, concentrations of phytotoxins, and anoxic conditions prevail in the rhizosphere. Trees do not only persist in a dormant state, but grow vigorously during most of the year. These extreme conditions are tolerated because of a large variety of adaptations to flooding, starting at the seed stage with hydrochory and ichthyochory as main means of dispersal, followed by fast germination and high tolerance to complete submergence in seedlings, and ending in a not yet completely apprehended number of adaptations in adult trees, at phenological, physiological, morphological and anatomical levels. Morphological adaptations of the root system comprise hypertrophy of lenticels, formation of adventitious roots, plank-buttressing and stilt rooting, development of aerenchyma, and the deposition of cell wall biopolymers such as suberin and lignin in the root peripheral cell layers. Water loss and gas exchange in the flooding period are effectively reduced by alterations in vegetative phenology and water storage. Since also these forests, as most wetland ecosystems, are threatened by human overpopulation and overexploitation, the challenge to understand and thus maintain this ecosystem increases every decade.

**Keywords:** Adaptations, increments, submergence, tree growth, waterlogging