



**Description of the classes of the urban submodules
Beta Collection (1985-2024) MapBiomás Venezuela**

Submodule	Classes	Description
Annual Urbanization	Urban	Area of human settlement with built environment infrastructure, including buildings and roadways. It also encompasses urban peripheries that are in constant expansion. In the Amazon, it includes indigenous communities.
	Other non-vegetated anthropic areas	Areas without vegetation cover, composed of various infrastructures such as industrial yards, ports, airports, dams, airstrips, main roads, and other infrastructures outside urban areas.
Urbanization Periods	Urbanized up to 1985	Represents the extent of built-up infrastructure and consolidated impervious surfaces at the start of the study period.
	Urbanized between 1986 and 1990	Land surface incorporated into the urban fabric during this five-year period. It results from the spatial subtraction of the 1985 urban footprint from the 1990 coverage, isolating the net growth of the period.
	Urbanized between 1991 and 1995	Superficie incorporada al tejido urbano durante este quinquenio. Resulta de la sustracción de la mancha urbana de 1990 a la cobertura detectada en 1995, aislando el crecimiento neto del período.
	Urbanized between 1996 and 2000	Land surface incorporated into the urban fabric during this five-year period. It results from the spatial subtraction of the 2000 urban footprint from the 2005 coverage, isolating the net growth of the period.
	Urbanized between 2001 and 2005	Land surface incorporated into the urban fabric during this five-year period. It results from the spatial subtraction of the 2000 urban footprint from the 2005 coverage, isolating the net growth of the period.

	Urbanized between 2006 and 2010	Land surface incorporated into the urban fabric during this five-year period. It results from the spatial subtraction of the 2005 urban footprint from the 2010 coverage, isolating the net growth of the period.
	Urbanized between 2011 and 2015	Land surface incorporated into the urban fabric during this five-year period. It results from the spatial subtraction of the 2015 urban footprint from the 2020 coverage, isolating the net growth of the period.
	Urbanized between 2016 and 2020	Land surface incorporated into the urban fabric during this five-year period. It results from the spatial subtraction of the 2015 urban footprint from the 2020 coverage, isolating the net growth of the period.
	Urbanized between 2021 and 2024	Land surface incorporated into the urban fabric during the final period. It results from the spatial subtraction of the 2020 urban footprint from the coverage detected at the end of the collection, isolating the most recent expansion.
Urban Vegetation Level 1	Urban Area (UA)	It represents the consolidated core of the city. It is technically defined based on the land cover classes from MapBiomass Venezuela: 'Urban Use' (class 24) and 'Other non-vegetated anthropogenic areas' (class 25). To delimit this perimeter, a spatial processing technique was applied to ensure a continuous and non-fragmented surface.
	Periurban Area (PUA)	It is defined as the complement of the urban area, delimited based on built-up areas and proximity criteria. Its perimeter is established using buffer zones differentiated by political-administrative hierarchy: 1,000 m for state capitals, 750 m for municipal capitals, 500 m for parish capitals, and 250 m for other populated centers.
Urban Vegetation Level 2	Non-vegetated urban area Non-vegetated periurban area	Comprises the built-up surfaces within the Urban Unit. It includes buildings, pavements, concrete, asphalt, and bare anthropogenic soils where vegetation cover is non-existent or minimal.
	Urban vegetation Periurban vegetation	Includes the vegetation cover (trees, shrubs, or grasslands) located within the boundaries of the Urban Unit (UA + PUA). It represents the green infrastructure, such as parks, squares, gardens, buffer zones, and remnants of natural vegetation that coexist with the built environment.

Urban Vegetation Level 3	Forest Formations	A set of natural land cover types dominated by arboreal vegetation, with vertical canopy structure and the presence of forests under terra firme, flooded, or coastal-influenced conditions.
	Grasslands and Shrublands	A set of natural non-forest land cover types dominated by herbaceous and shrub vegetation, including formations associated with flooded, xerophytic, Andean, tepui, and rocky environments.
	Agricultural Areas	A set of anthropogenic land cover types intended for agricultural, livestock, and forestry production, including pastures, crops, mixed-use systems, fallow land, and forest plantations.
	Non-vegetated Areas	A set of natural or human-altered surfaces with absent or very low vegetation cover, including urban areas, mining areas, beaches, dunes, and infrastructure.
	Water Bodies	A set of surfaces occupied by water or permanent ice, of natural or artificial origin, including both inland and marine-coastal environments.
Urban Vegetation Level 4	Forest	Natural formation dominated by tree elements, generally with vertical stratification and the presence of various forms of growth according to the stratum: terrestrial herbs, vascular and non-vascular epiphytes, shrubs, and lianas. It has at least one continuous canopy stratum. These forest communities include evergreen, semi-deciduous, and deciduous species. They can be found in a wide variety of landscapes such as plains, plateaus, foothills, terraces, hills, ridges, mountains, and valleys
	Wooded savanna	Formation dominated by grasses, in addition to other herbaceous components. Generally, it presents low and twisted tree and/or shrub individuals with adaptations to fire. The most common woody elements in savannas are the chaparro (<i>Curatella americana</i>), the corkwood (<i>Bowdichia virgilioides</i>), and the manteco (<i>Byrsonima crassifolia</i>). Although there is great heterogeneity in savannas, where other woody species dominate, isolated tree clusters known as 'mata' can also be found, and occasionally isolated or grouped palms in various types of palm groves. The wooded savanna interrupts a more or less continuous and dominant matrix of often xeromorphic herbaceous plants, commonly known as savanna.

	Mangrove	Forest restricted to coastal and estuarine deltaic areas, composed of halophytic trees. It is distributed in coastal zones, located in tidal influence areas and in brackish coastal lagoons. The four main constituent species of this type of forest are: red mangrove (<i>Rhizophora mangle</i>), black mangrove (<i>Avicennia germinans</i>), white mangrove (<i>Laguncularia racemosa</i>), and buttonwood mangrove (<i>Conocarpus erectus</i>).
	Flooded forest	Forest formation subject to a regime of permanent or seasonal, intra- or inter-annual flooding. Topographically, it is associated with river floodplains, depressions, marshy environments, or deltas, and alluvial plains affected by sedimentation and changes in river course.
	Flooded grassland/shrubland	Formations in which herbaceous and/or shrub-like growth forms can dominate. These communities are subject to a regime of permanent or seasonal, intra- and inter-annual flooding. Topographically, these communities are associated with river floodplains, depressions, marshy environments, deltas, and alluvial plains affected by sedimentation and changes in river courses. It includes floodable savanna communities in Los Llanos. This class also encompasses aquatic vegetation communities and even floating vegetation, savannas with palms, and broad-leaved herbaceous vegetation over swamps. In the Andes it is associated with moraine lagoons and high-altitude wetlands at elevations above 3000 meters above sea level.
	Grassland	It encompasses a wide variety of predominantly herbaceous formations. Savannas are primarily distributed in Los Llanos. These are communities characterized by a more or less dense and continuous herbaceous stratum dominated by grasses, often of the feather grass (<i>Trachypogon spicatus</i>) type, as well as other similar habit species belonging to the genera <i>Axonopus</i> , <i>Panicum</i> , and <i>Paspalum</i> .

	Rocky outcrop	<p>Naturally exposed rocks or young soils on the Earth's surface or exposure to lithological material from landslides.</p> <p>In the Andes, there are the Subnival and Nival elevations (> 4600 meters above sea level) where vegetation cover is scarce and gradually decreases with elevation. These are areas of great ecological importance, due to the tangible evidence of climate change, in substrates formerly occupied by glaciers, where processes of primary succession of vegetation occur.</p> <p>In the Amazon, occasionally with partial coverage of saxicolous vegetation (that which grows on rocky outcrops, rock walls, or hillside debris) or rupicolous vegetation (grows in rock crevices and fissures), which constitute highly specialized communities that grow on rocky substrates.</p>
	Hypersaline tidal flat	<p>Coastal lagoon formed by detrital sediments on coastal areas, bays, and estuaries. It is characterized by its concave and shallow topography. Generally, it exhibits high rates of evaporation. The salinity and depth of the water sheet depend on freshwater currents, precipitation, and the type of connection with tides. In this collection it includes salt flats.</p>
	Shrubland	<p>It is composed of a variety of shrub communities dominated by woody individuals that branch from the base. Generally, with heights of less than 5 meters and an irregular canopy. It may include armed species in communities of cardonales (cactus communities) and thorn scrub in coastal areas.</p>
	Xerophytic grassland/shrubland	<p>Formation composed of often succulent, creeping herbaceous plants and/or low, sparsely covered shrublands.</p>

	Other non-forest natural formations	<p>In the Venezuelan Andes there is an association of Herbazal/Arbustal paramero, with a high diversity of growth forms that include: caulescent rosettes (stemmed), shrubby growth forms (paramo shrubland) as well as graminoid and non-graminoid herbs. It occurs in the Andino to Alto Andino elevation (3000 to 4600 meters above sea level) where soil cover gradually decreases from 4200 meters above sea level. These ecosystems exhibit high diversity and endemism.</p> <p>In the Amazon, there is vegetation specific to the tepuis, including the association of tepui grasslands/shrublands, composed of unique growth forms such as broad-leaved herbs, tubular plants, rosettes, and fruticose plants on rock, sand, and peat. These ecosystems exhibit high diversity and endemism.</p>
	Andean herbaceous/shrubby vegetation	<p>This cover type features a high diversity of herbaceous and shrubby growth forms, including caulescent rosettes, sub-shrubs, and graminoid and non-graminoid herbs. It is found in the Andean to High Andean altitudinal belts (3000 to 4600 meters above sea level), where ground cover gradually decreases from 4200 m.a.s.l. These ecosystems are known for their high diversity and endemism.</p>
	Flooded Andean herbaceous/shrubby vegetation	<p>This herbaceous/shrubland is associated with aquatic systems such as lagoons, peatlands, and runoff areas located in the Andean regions. It develops in high-altitude wetlands and moraine-origin lagoons at elevations above 2800 m.a.s.l.</p>
	Pasture/Fallow lands	<p>Pasture area where natural vegetative cover has been altered or replaced through the cultivation of grasses and legumes used for livestock feed. This class includes fallow lands.</p>
	Agriculture/Fallow lands	<p>Cultivation of plants with the aim of utilizing various parts, which can be fruits, leaves, stems, roots, tubers, etc. It encompasses a wide variety of production systems, ranging from extensive to intensive, including dryland farming, irrigated farming, and conucos (small traditional plots). This class also includes fallow land. In the Amazon, it includes the conucos of indigenous peoples, where it is common to produce crops such as yam (<i>Dioscorea</i> spp.), corn (<i>Zea mays</i>), cassava (<i>Manihot esculenta</i>), plantain (<i>Musa</i> spp.), among others.</p>

	Cropland/Pasture/Fallow lands	It encompasses pasture cultivation and agriculture, which includes a wide variety of plant crops in a diverse range of production systems. It is not possible to distinguish the boundaries between pastures and agriculture. This class includes fallow lands. This class is present north of the Orinoco River and in the state of Guayana Esequiba.
	Forest plantation	Monospecific cultivation of standing trees, generally pine species (<i>Pinus</i> spp.) or eucalyptus species (<i>Eucalyptus</i> spp.), for the production of saw timber, wood chips, or pulp for papermaking.
	Beach or dune	Sandy plains in coastal areas, accumulation areas in river floodplains, and the edges of bodies of water. It also includes dunes, which consist of rounded or elongated accumulations of sand of aeolian origin.
	Urban	Area of human settlement with built environment infrastructure, including buildings and roadways. It also encompasses urban peripheries that are in constant expansion. In the Amazon, it includes indigenous communities.
	Mining	<p>Areas for mineral extraction, typically involving soil removal and exposure of lithological material. It includes various types of industrial mining. In northern Venezuela, it mainly involves the extraction of non-metallic minerals.</p> <p>In the Amazon, there are typically operations for metallic minerals, primarily gold. This includes artisanal, riverbank, or illegal extraction that results in the loss of vegetative cover, as well as soil removal and erosion.</p>
	Other non-vegetated natural areas	Surface with little or no natural vegetation cover, with less than 10% ground cover. It can be found in floodplains, arid zones, and a variety of landscapes such as hills, mountains, slopes, and ridges; it can also include landslides and mass movements.
	Other non-vegetated anthropic areas	Areas without vegetation cover, composed of various infrastructures such as industrial yards, ports, airports, dams, airstrips, main roads, and other infrastructures outside urban areas.
	River, lake or ocean	Area covered by natural or artificial surface water. It includes rivers, lakes, reservoirs, and other water bodies, as well as marine-coastal areas.

	Glacier	Permanent ice cover, resulting from processes of snow accumulation and compaction. In the Venezuelan Andes, it occurs at summits at elevations around 4,800 meters above sea level. Venezuela's glaciers are the first to disappear in South America due to the effects of climate change, with a small glacial surface reported until 2020.
	Aquaculture	Infrastructure composed of artificial ponds for the cultivation of fish, shrimp, and other aquatic invertebrates of commercial interest.
	Not observed	Missing data.
Urban slope	Up to 10%	Areas with predominantly flat to gently undulating relief. These represent surfaces with the fewest physical constraints for urban development.
	Between 10-25%	Areas with undulating relief. These indicate transition zones where urban development requires moderate technical interventions for land grading and drainage.
	Between 25-45%	Areas with rugged or mountainous relief. These surfaces present significant restrictions for urbanization.
	Above 45%	Areas with steep relief or high slopes. These represent zones of high ecological fragility and geomorphological, where urbanization is limited or considered critical.
Height above nearest drainage	Up to 3 m	Areas with very low vertical elevation relative to the nearest watercourse.
	Between 3 and 6 m	Areas of moderate elevation above drainage.
	Above 6 m	Areas with greater relative height with respect to the drainage system.
Urban seismicity	Very Low	Zone located very far from seismic faults, where vibrations may be felt very slightly.
	Low	Zone located far from seismic faults, but where slight vibrations may still occur.
	Moderate	Zone distanced from seismic faults, with the occurrence of earthquakes and moderate vibrations.
	High	Zone located near major seismic faults, with the occurrence of large earthquakes and severe vibrations.
	Very High	Zone located very near to the most important seismic faults, with the occurrence of large earthquakes and very intense vibrations.