



Programa de Pós-graduação em Química



Programa de Pós-graduação em Ciências Aplicadas a Produtos para a Saúde



“AS MULTIPLAS DIMENSÕES DA SUSTENTABILIDADE” **“THE MULTIPLE DIMENSIONS OF SUSTAINABILITY”**

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*“The **perception** of most people is that sustainability is only related to the emissions of gases into the atmosphere, such as **carbon dioxide**, and that this is the only risk to which the planet is exposed. this is a mistake”.*

Susana I. Córdoba de Torresi, Vera L. Pardini, Vitor F. Ferreira. **O que é sustentabilidade?** Quim. Nova, Vol. 33, No. 1, 5, 2010.

Química Verde, Economia Sustentável e Qualidade de Vida. Ferreira, V. F.; da Rocha, D. R.; da Silva, F. C. **Rev. Virtual Quim.**, 2014, 6, 85-111

Sustainability is a great umbrella of society and must be seen as if it were a reality and a daily experience for everyone.

Alimentação para todos, Água potável, Energia renovável, alimentos limpos, saúde integral, meio ambiente saudável, tratamento do lixo, circulação dos rejeitos, empresas ecológicas.

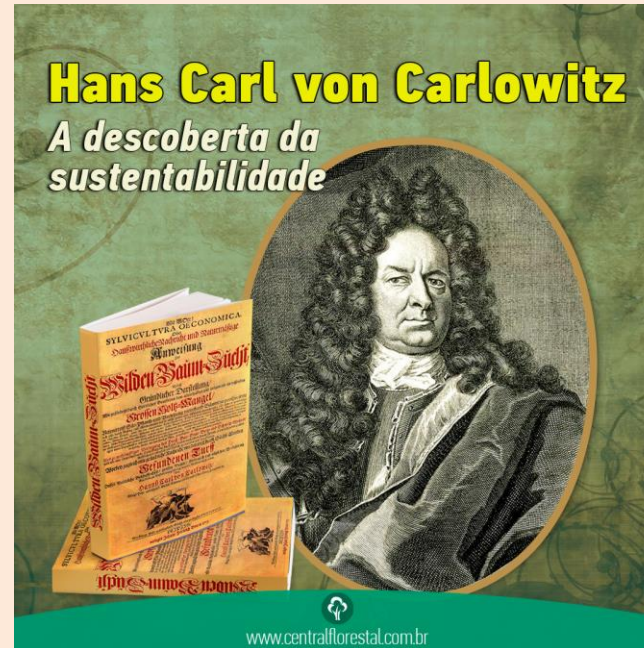
Sustainability is: Sustain, Balance, Conserve, Protect, Nourish, Nourish, Thrive

Derived from the German Word Nachhaltigkeit (1560)

Capitão Hans Carl Von Carlowitz (1713)

Carl Georg Ludwig Hartig (1795)

They predicted a disaster if there was no rational use of forests.



Different rhythms of industry with nature.

The **CAUSES AND EFFECTS** of human activities on the planet are visibly present in the oceans, rivers, air, forests and polar ice caps.

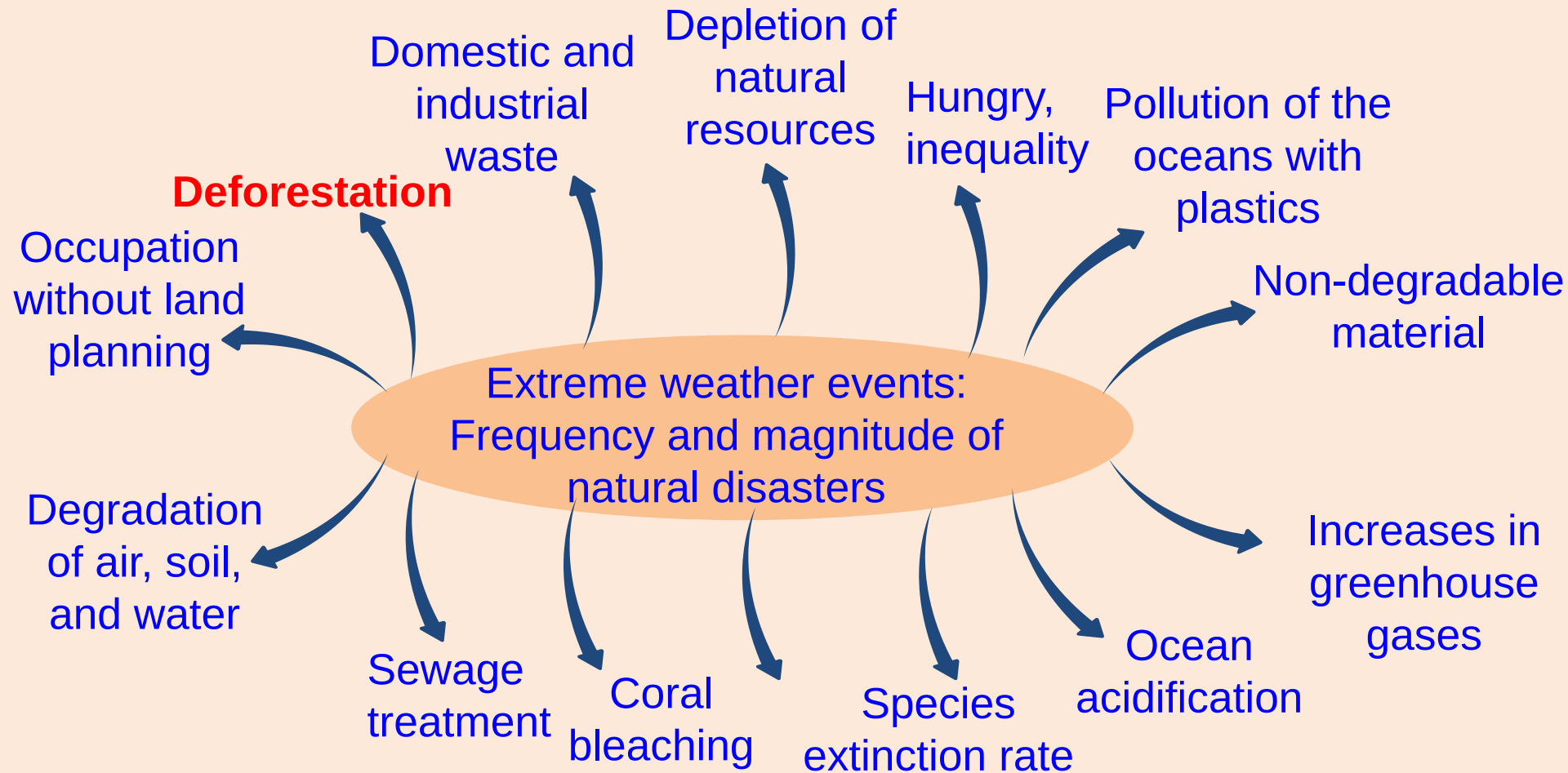
EVERYTHING ON THE PLANET IS CONNECTED AND INTERDEPENDENTLY

CAUSE AND EFFECT

The citizen, government and private sector are the central agents that must maintain the **balance between water, air, soil, forests, oceans, etc.**

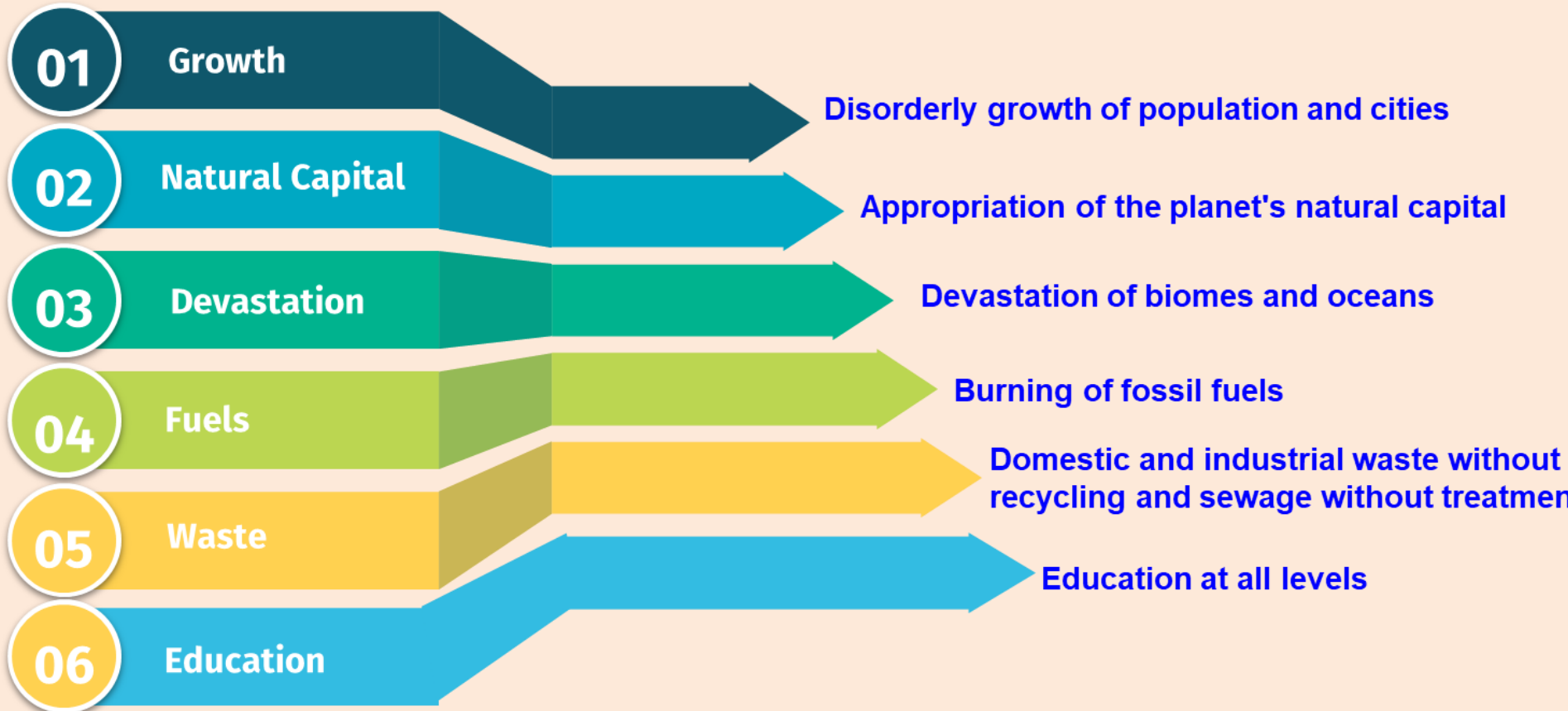
It's no use paying attention to just one of these items. Everything has to be thought out and executed in all aspects of a SUSTAINABLE CHAIN, otherwise this action can only be considered as a deception or a sustainability “painted in green”.

CAUSES



CAUSE

Some factors that contribute to extreme weather events

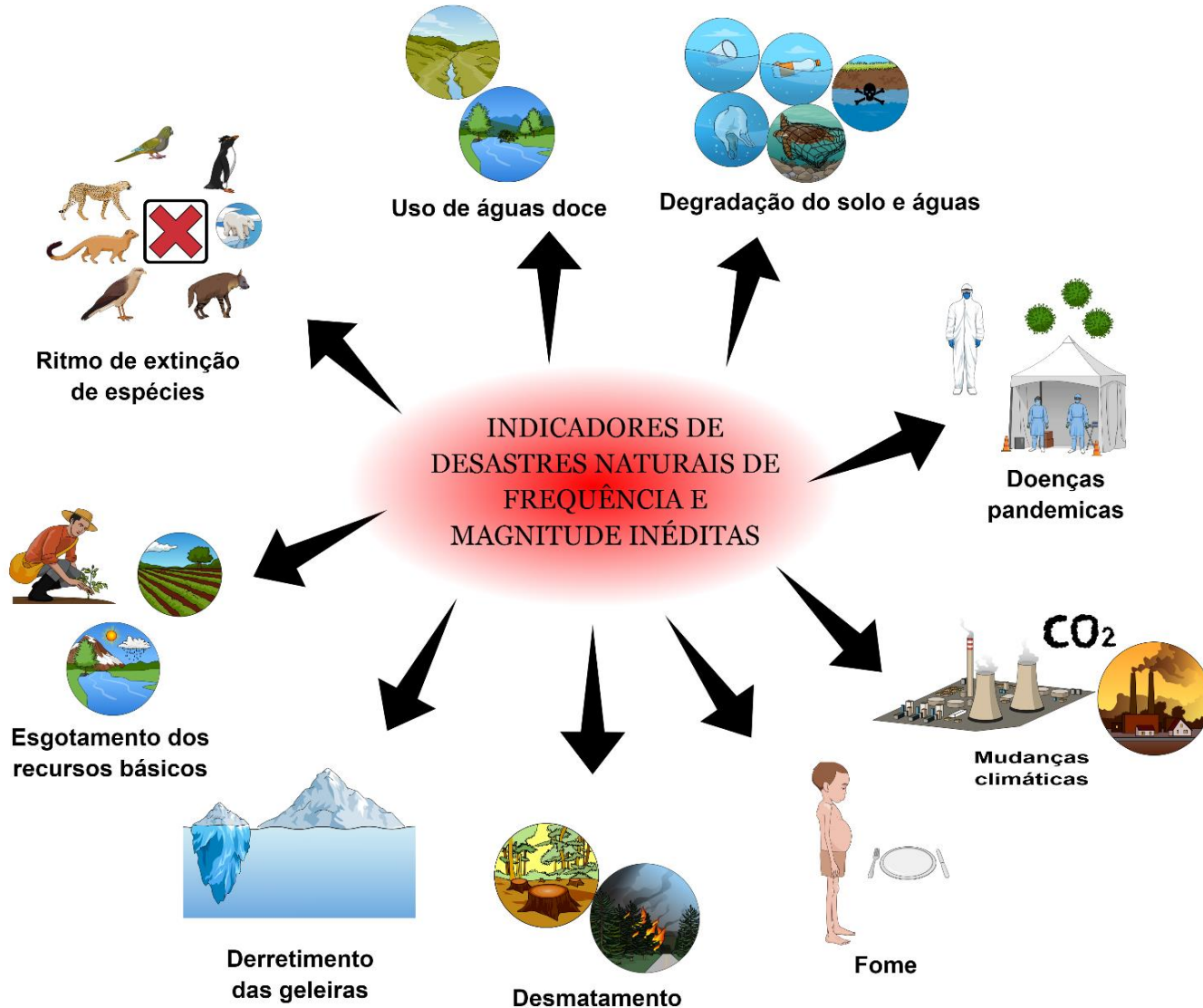


CAUSE

8 Billion

A large, glossy, purple 3D number 8 is centered in the background. The number has a metallic sheen with highlights and shadows, giving it a three-dimensional appearance. It is positioned behind the text '8 Billion', which is written in a bold, white, sans-serif font. The entire graphic is set against a solid purple rectangular background.

SIGNS OF ENVIRONMENTAL TISSUE STRETCHING EFFECT



SDGs proposed by the UN in 2015

EFFECT

Sustainable Development Goals (SDGs)	1 No poverty	2 Zero hunger	3 Good health and well-being	4 Quality education	5 Gender equality
6 Clean water and sanitation	7 Affordable and clean energy	8 Decent work and economic growth	9 Industry, innovation and infrastructure	10 Reduced inequalities	11 Sustainable cities and communities
12 Responsible consumption and production	13 Climate action	14 Life below water	15 Life on land	16 Peace, justice and strong institutions	17 Partnerships for the goals

FORESTS

Forests are areas with a high density and variety of trees, shrubs, creeping plants, animals, birds, insects and microorganisms attached to the plants and soil that occupied the entire planet.

Its diverse natural resources have played important roles in ensuring conservation and sustaining the livelihoods of millions of people around the world, including indigenous and rural communities.

WHAT ARE THE ADVANTAGES OF CONSERVING FORESTS?

The worst cause of global weather events.

If a species cannot find a new habitat or adapt to changes in land use, it often goes extinct. Your unique genetic information and position in the ecosystem are lost.

DEFORESTATION is the large-scale destruction of trees on an area of land by disease, cutting, fire, pasture fire, flooding, erosion, pollution or volcanic activity.

- ✓ **Temperate rainforest**
- ✓ **Dry tropical forest**
- ✓ **Rainforest**
- ✓ **Old**

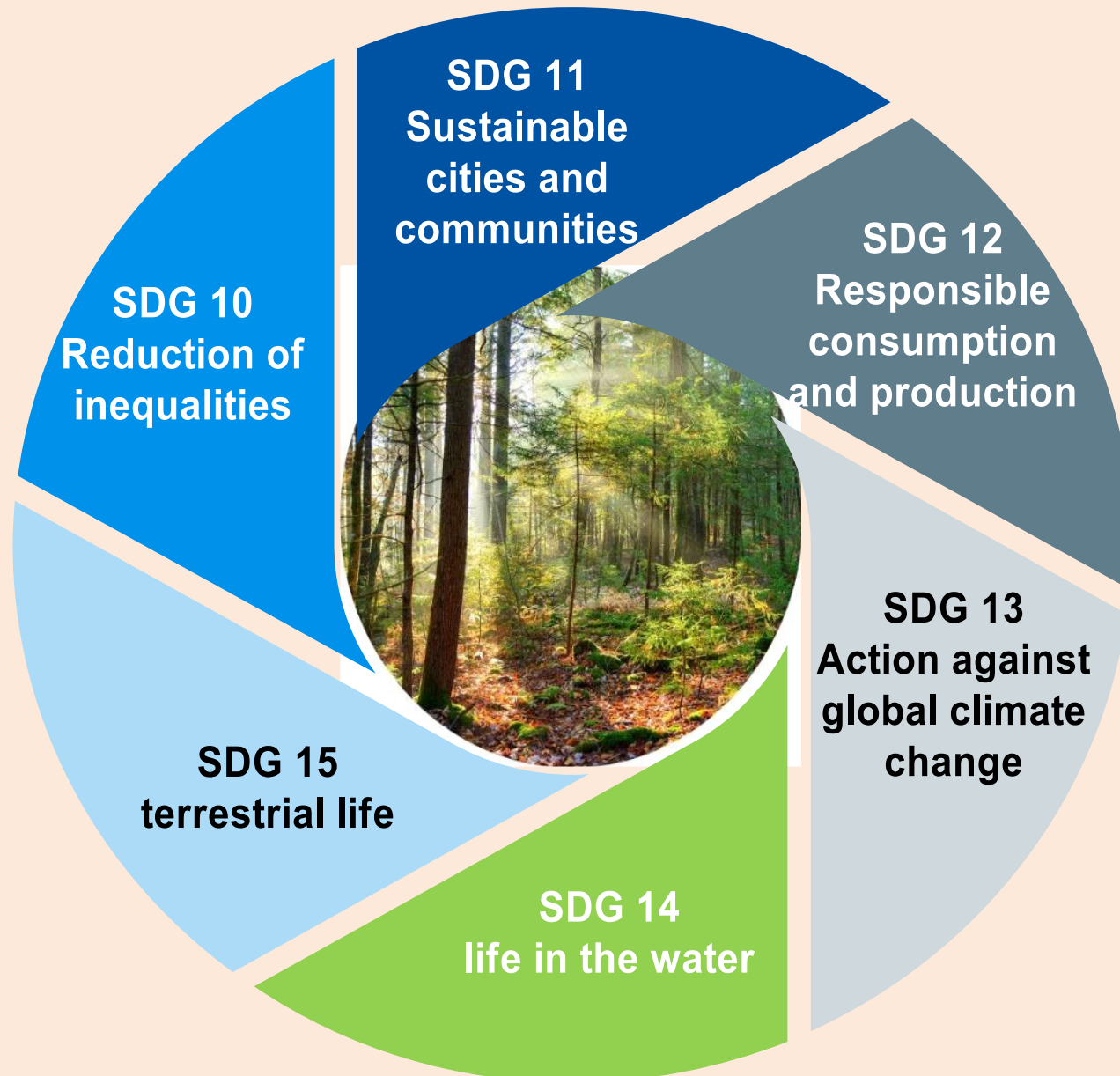


Homogeneous forests
Eucalyptus

Ancient forests are made up of trees that are usually several thousand years old and take at least 100 years to grow back to maturity if they are cut down.

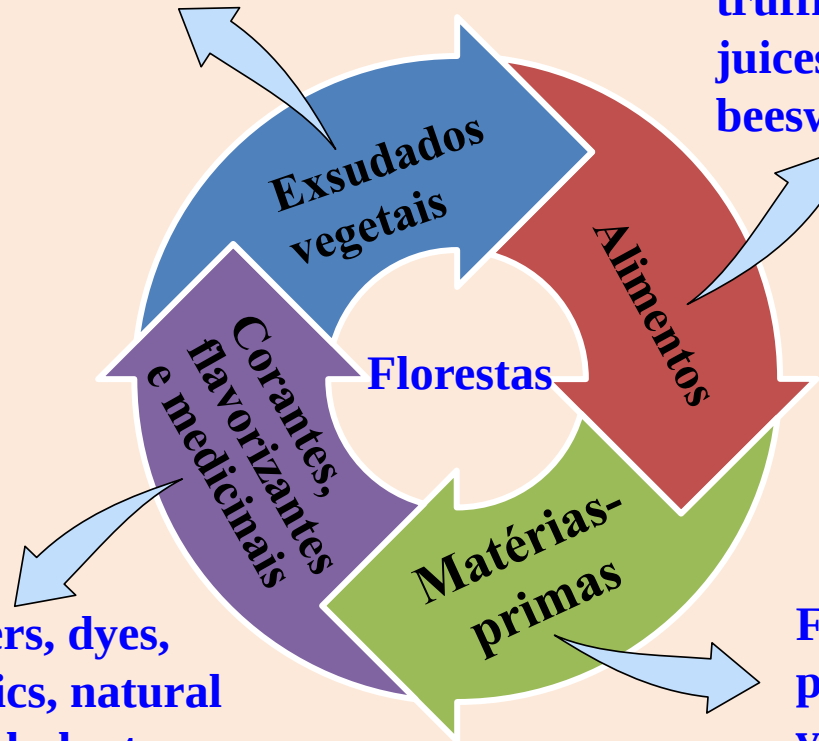
The forests, such as the **Amazon, Cerrado, Atlantic Forest, Caatinga, Pampa and Pantanal**, which hold a rich diversity of species (9.5%) of fauna and flora, about **50 thousand species** of higher plants representing approximately **19%** of the world total.

The Sustainable Development Goals (SDGs) that are related to the preservation of forests.



**Latex, non-elastic gums,
resins, gums, essential
oils, waxes, incense.**

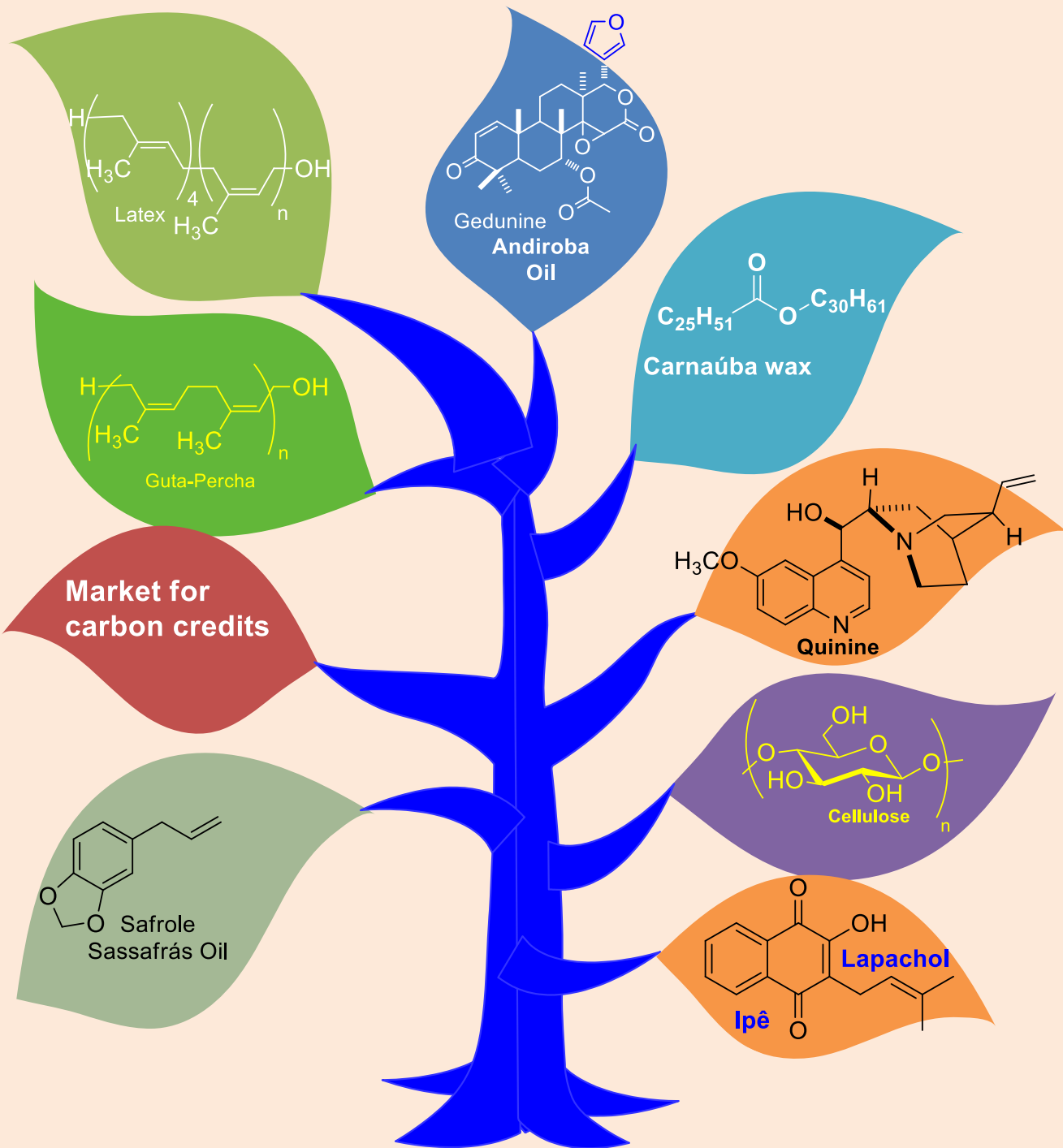
**Fruits, nuts, mushrooms, edible
truffles, ice cream, herbs, spices,
juices, beverages, oils, honey and
beeswax.**



**Condiments, peppers, dyes,
fragrances, cosmetics, natural
pigments, medicinal plants.**

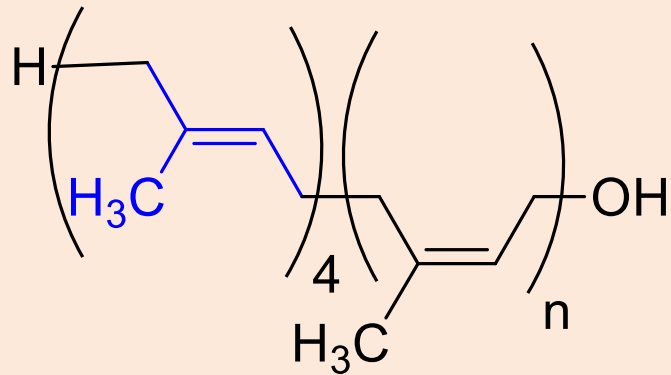
**Fine chemicals, medicines,
perfumery, textiles, paints,
varnishes, sealants, varnishes,
Building materials, utensils.**

Example of valuable natural products that can be obtained from forests

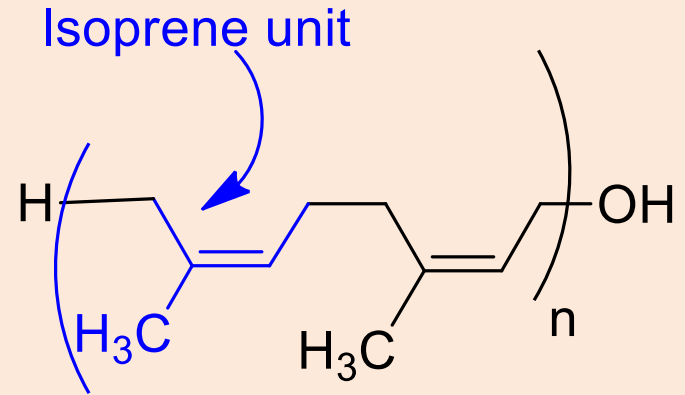


The rubber tree (*Hevea brasiliensis*) is the tree from which 99% of the latex is extracted to prepare natural rubber.

Prevalent in the southern region of the Amazon, extending to the states of Acre, Mato Grosso and Paraná in Brazil, parts of Bolivia, Peru, northern Amazonia west of Manaus, to southern Colombia.



Natural Rubber or Latex
(about $10^3 - 10^5$ isoprene units)
cis isomer



gutta-percha
(10 times less isoprene units)
trans isomer

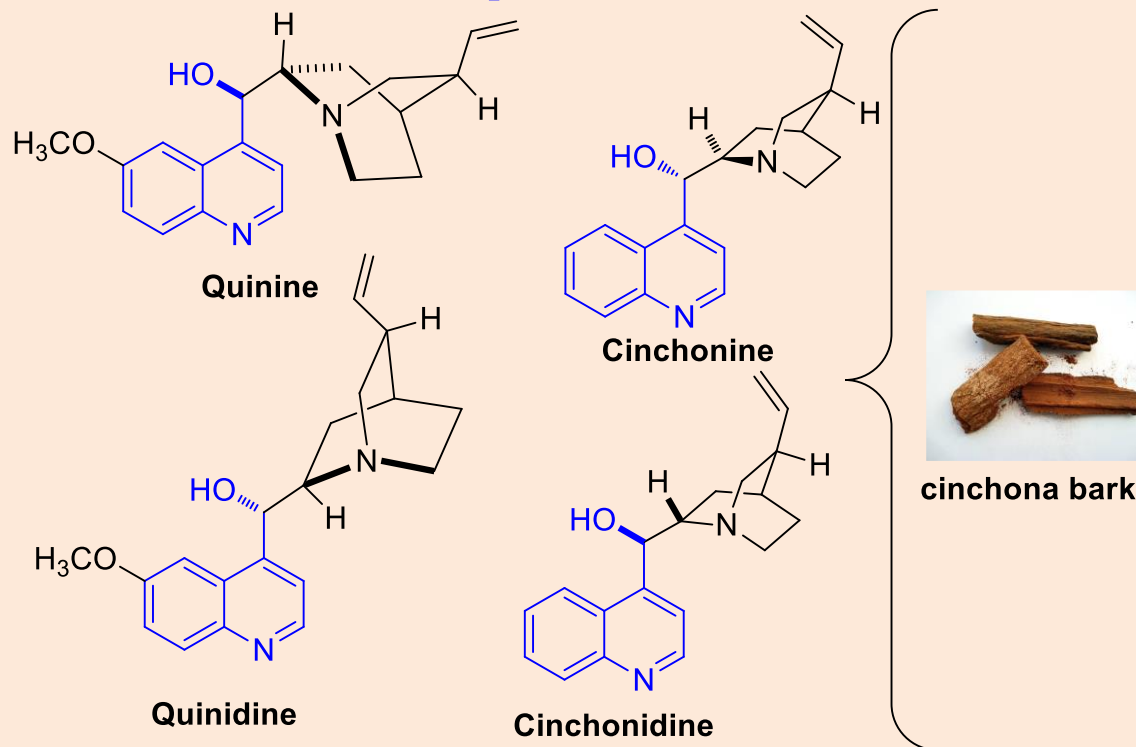
Global natural rubber production is projected to have a compound annual growth rate (CAGR) of 5.0% during the period 2022-2027 and is estimated to reach **US\$21.4 billion by 2027**.

The global gutta-percha market was valued at US\$182.0 million in 2020 (**US\$268.82 million in 2027**), i.e., expanding at a compound annual growth rate (CAGR) of 5.77% from 2021 to 2027.

Cinchona bark contains 6-10% quinoline alkaloids. The main constituents of alkaloids are quinine, quinidine, cinchonine and cinchonidine, in addition to 30 other minor bases related to quinine



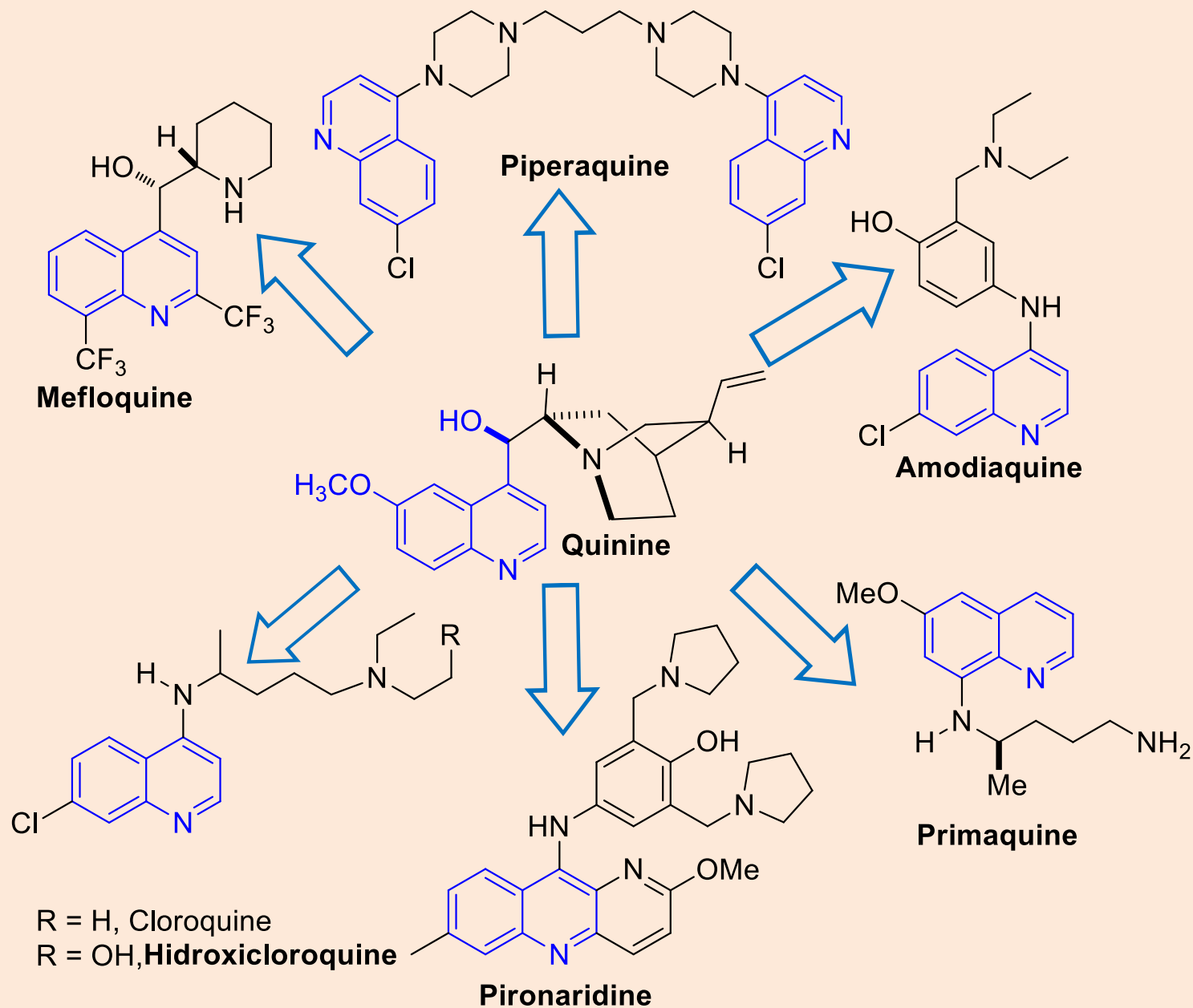
Plasmodium spp. (*P. falciparum*, *P. Vivax*, *P. malariae*, *P. ovale* and *P. knowlesi*)



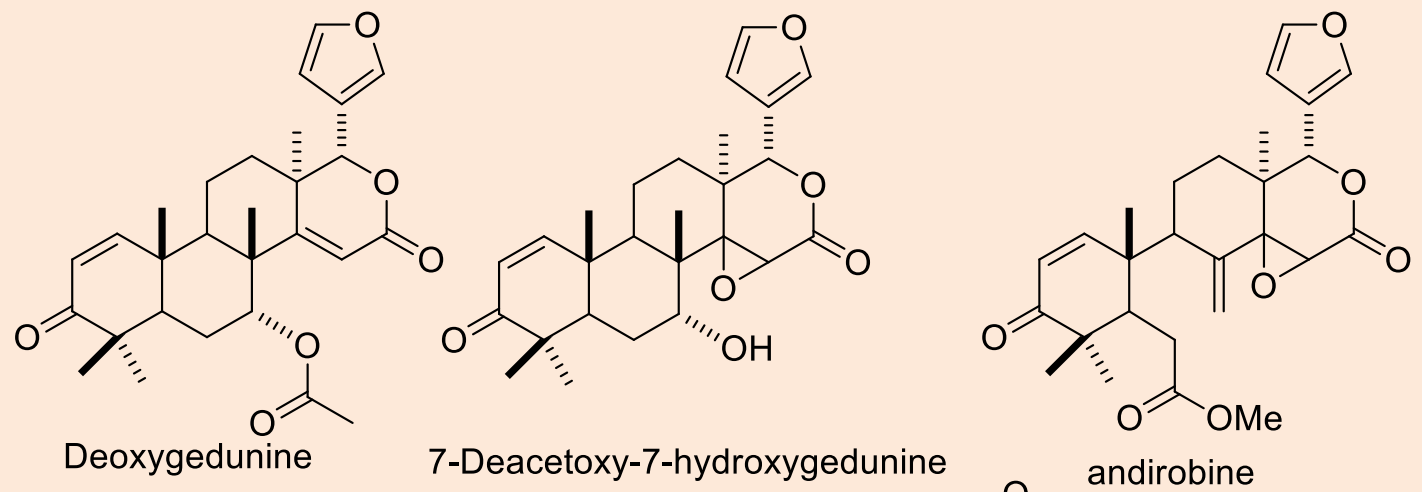
It is now grown in many tropical regions and annually produces somewhere around 8,000 to 10,000 tonnes of bark, yielding 400 to 500 tonnes of quinine.

The global Quinine Sulfate market will grow at a CAGR of 5.68% between 2019 and 2025. **Global demand was valued at approximately US\$804.98 million in 2018** and is expected to generate revenue of approximately US\$1,184.15 million by the end of 2025.

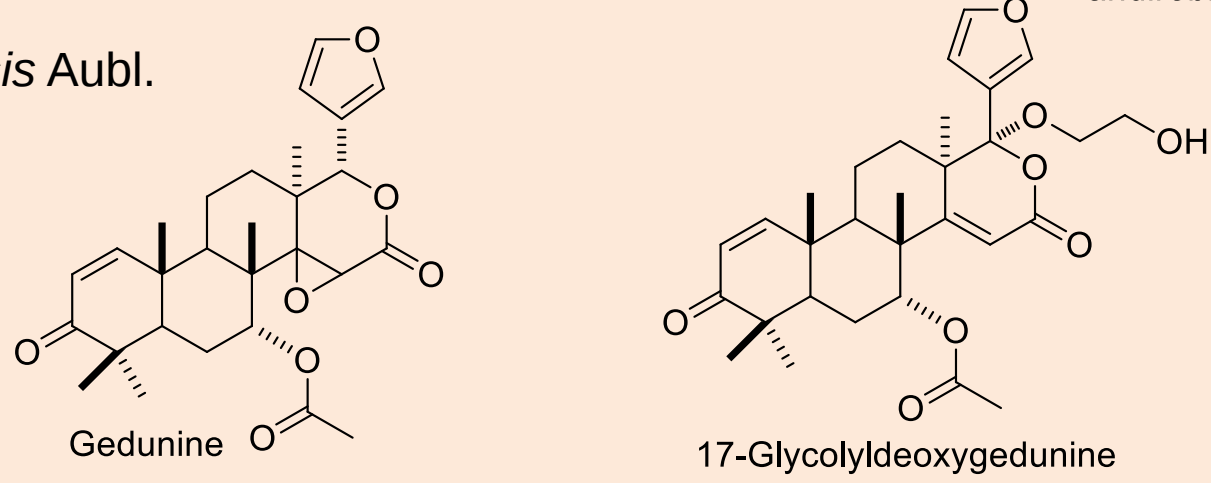
Quinine inspired drugs



Andiroba is a tall tree that can reach 30 meters in height. It is native to the Amazon forests of Brazil and Peru, but has spread to other forests in Western India and South Africa. Andiroba (botanical name).

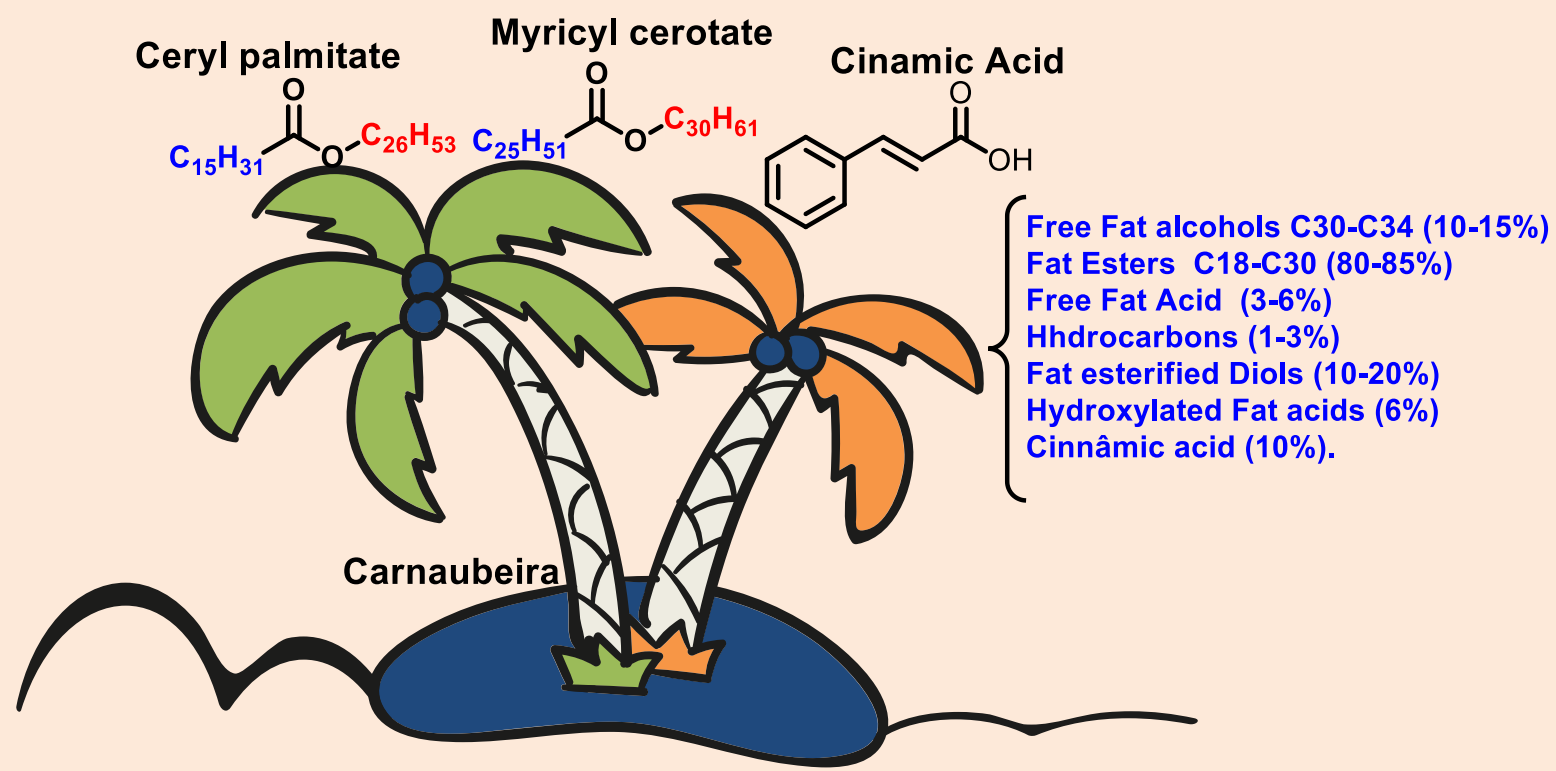


Carapa guianensis Aubl.



The global andiroba oil market is estimated to be **US\$95.1 million in 2021** and is projected to reach **US\$145.02 million in 2028**, exhibiting a robust 2022-2028 CAGR of 6.21%

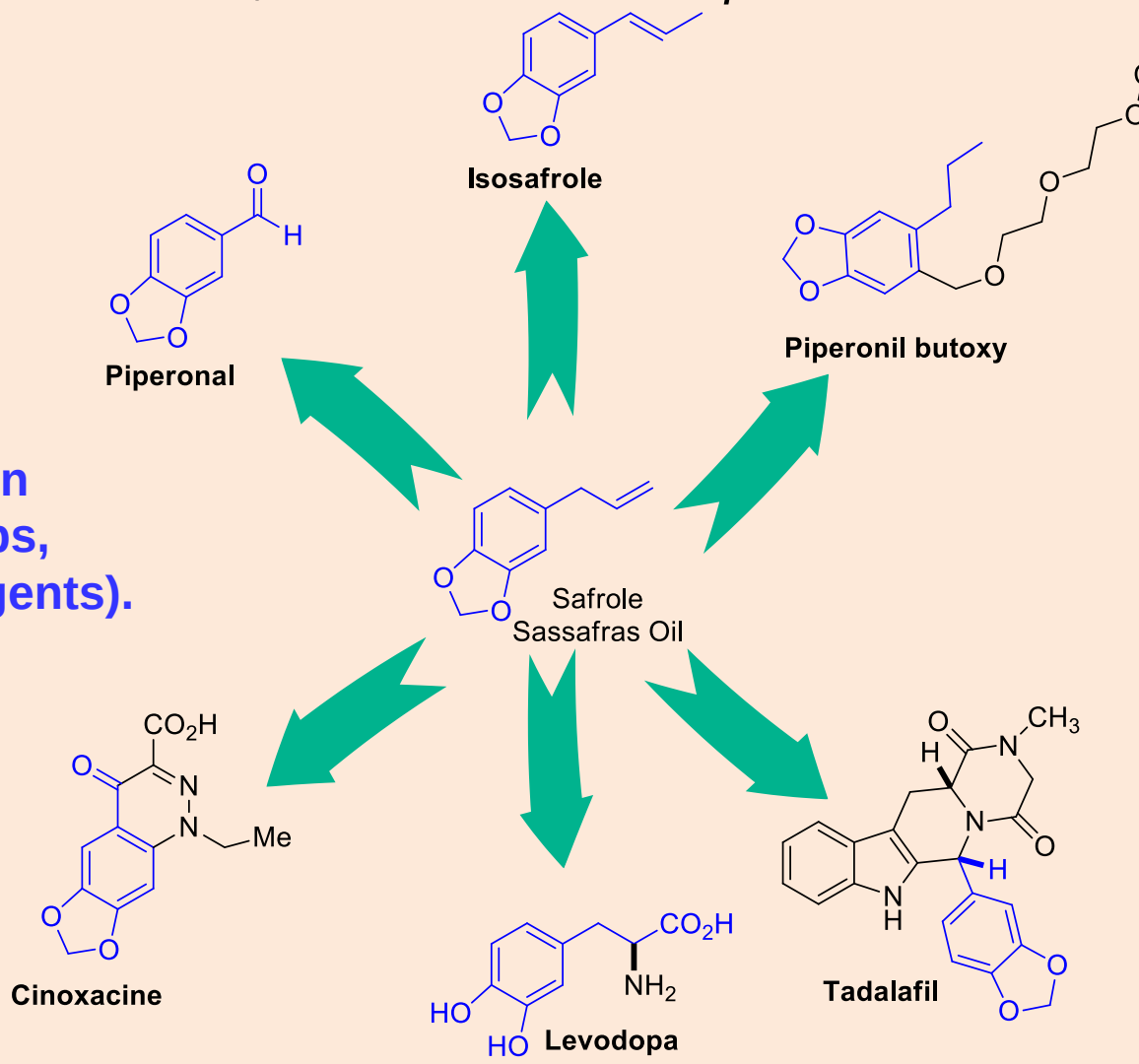
The palm trees of the Arecaceae family, the carnaubeira (*Copernicia prunifera* (Miller) H.E) stands out, native to Brazil and adapted to the dry climate, sandy and swampy soils, floodplains and banks of the Caatinga rivers.



The global carnauba wax market size was US\$246.0 million in 2015 and is expected to grow significantly in the next eight years due to the increasing usage.

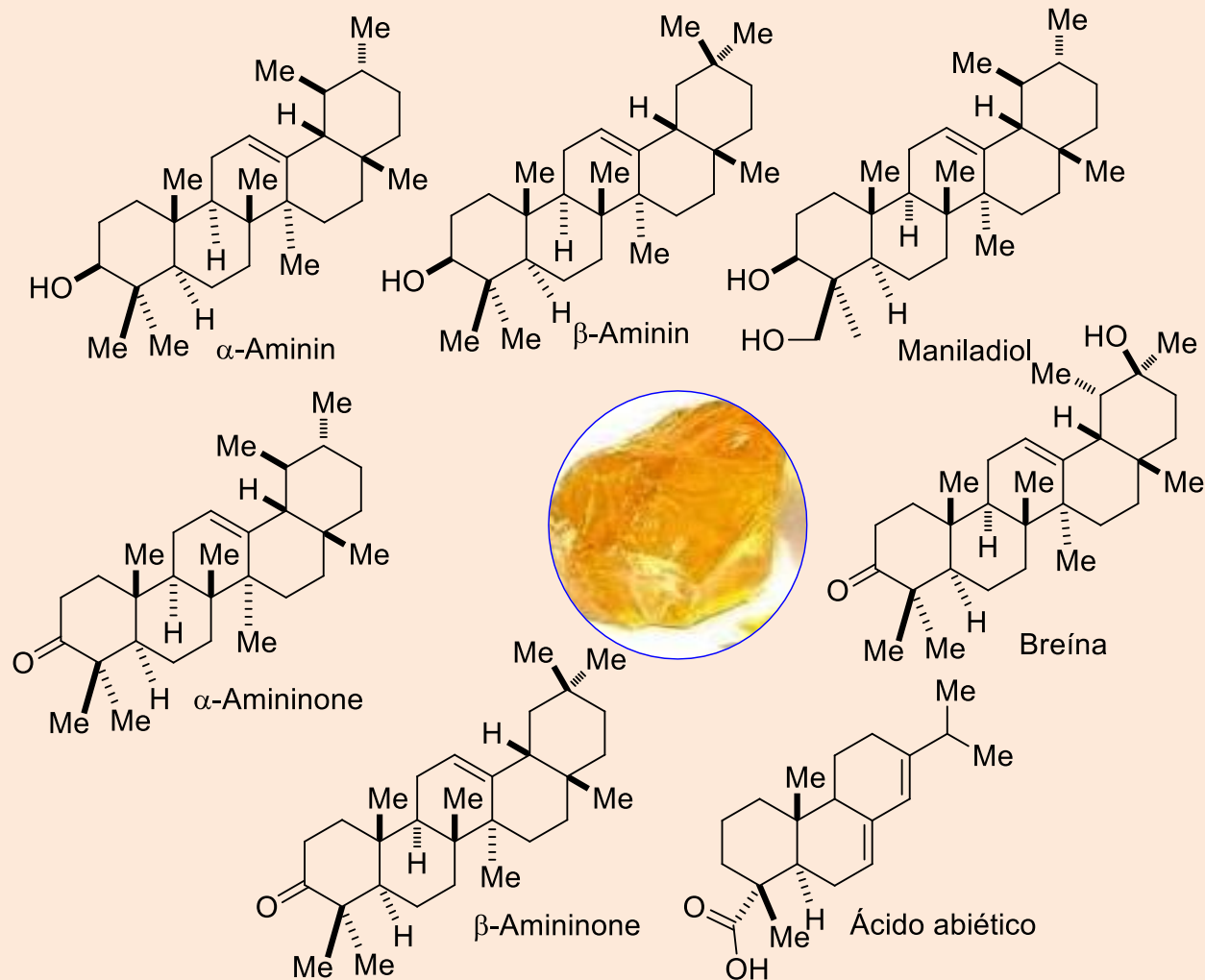
Examples of uses of safrole in organic synthesis

Sassafras oil can be extracted from several plants and is attractive because it is a renewable and biodegradable product. Plants of the Lauraceae family, such as *Ocotea pretiosa* (Nees) Mez., *Ocotea odorifera*, *Cinamomum petrophilum*, *Cinamomum mollissim*, *Cinnamomum camphora* and *Sassafras albidum* Nutt.



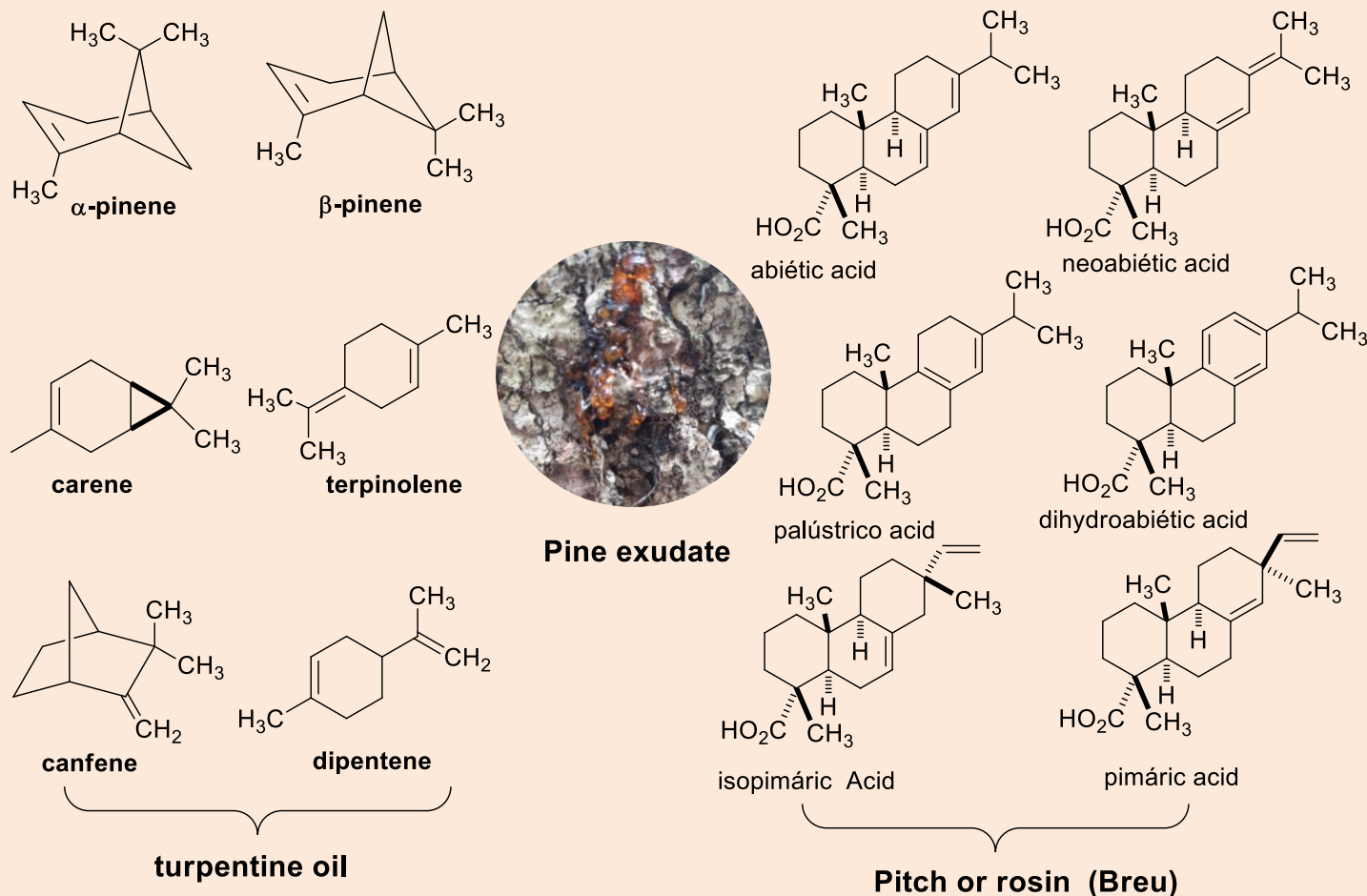
Domestic use (fragrances in floor waxes, polishes, soaps, detergents and cleaning agents).

COPAL is the solid resin obtained from several species of the Burseraceae botanical genus, such as, for example, the Protium copal, which is an endemic tree from Mexico and other American countries.



These aromatic resins have an extensive international market. This market for copal resin is expected to grow at a CAGR (Compound Annual Growth Rate), or compound annual growth rate of 5.5% between 2018-2030.

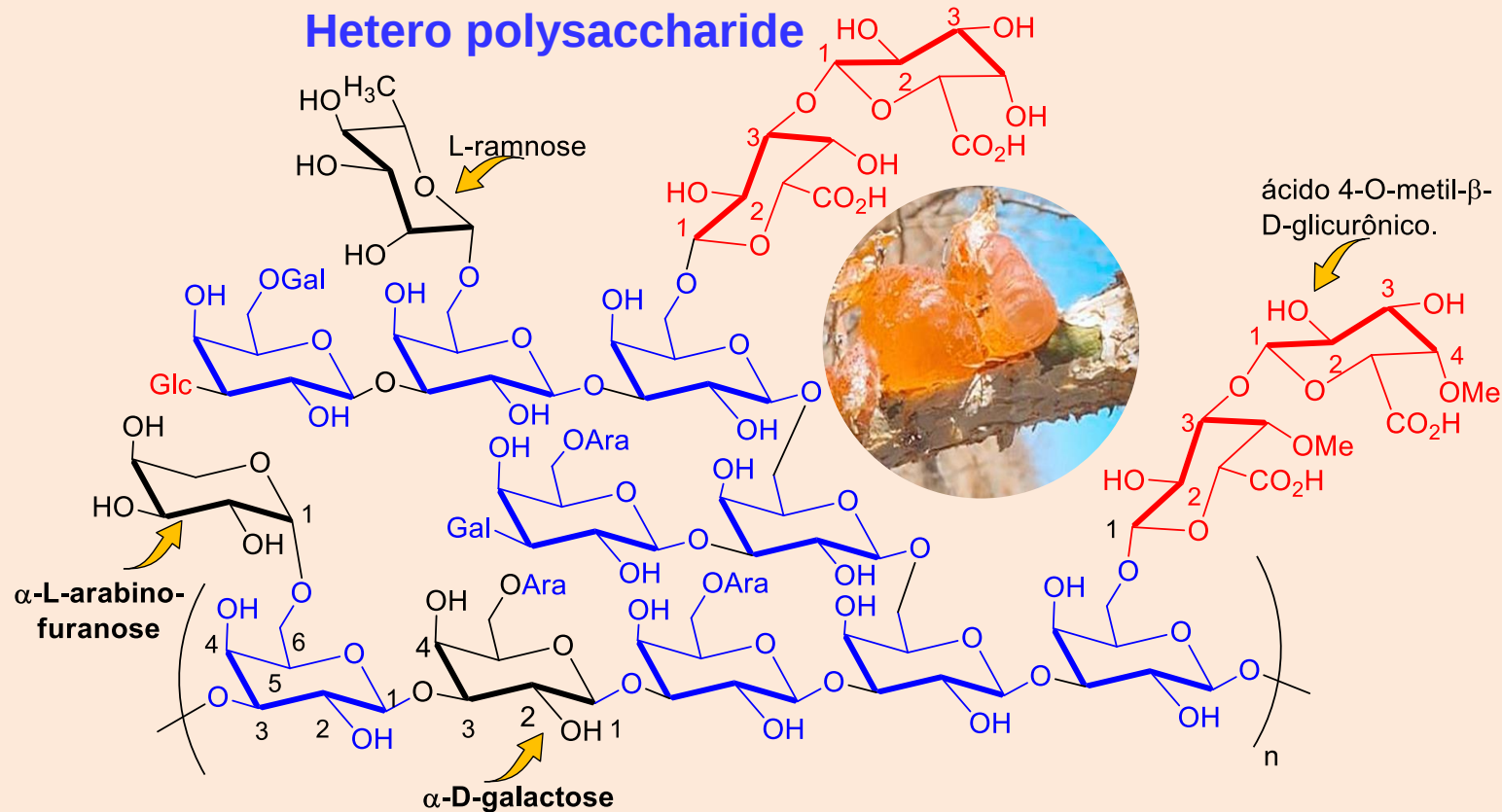
In several forests on the planet there are many species of Burseraceae that produce exudates on the trunks, exudates known as pine resin that contain 30% of oil (volatile part turpentine) and about 70% of the solid (pitch or rosin).



Turpentine has a large international global market that is estimated to reach US\$1.05 billion by the end of 2022 and will reach US\$1.51 billion in 2028 with a CAGR of 5.4%

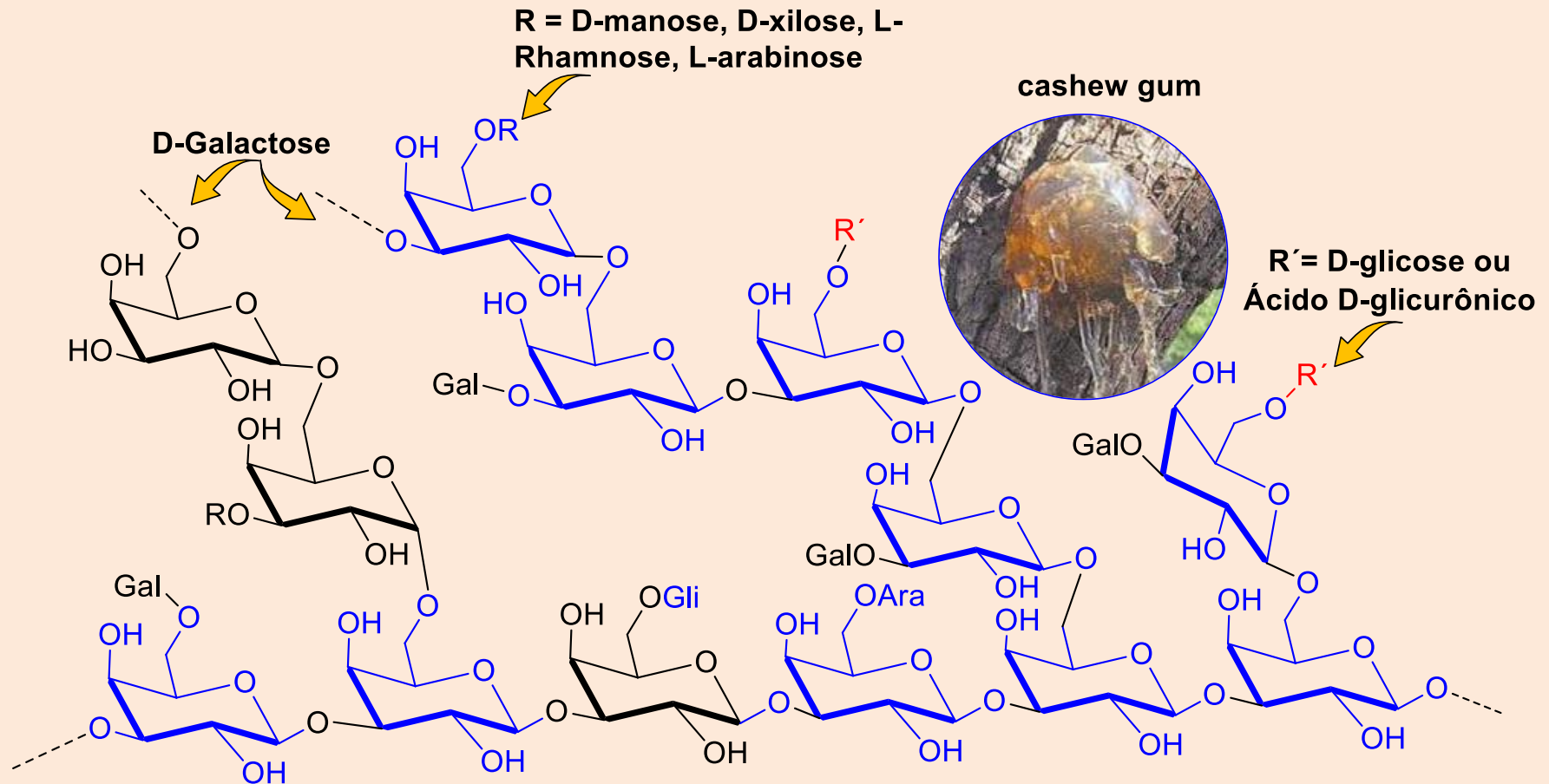
Coating agent, fat substitute, thickener, gelling agent, texturer and stabilizer in the food, beverage, pharmaceutical, cosmetics and paint industries, film forming agent, wetting agent, antioxidant, suspending agent in the production of pharmaceutical products (eg thickener for syrups and tablet coating), cosmetic formulations, chewing gum, papermaking, additive in ceramic glazes, meat processing, encapsulation of flavors, aromas and colorings in powder form processing of vegetable juices, confectionery products, sweets and chocolates.

The main sources of **gum arabic** are from the plants *Acacia Senegal* (L.) and *Acacia seyal*. By the end of 2025, the former will be the primary source and the best-selling gum at US\$270 million, while the latter will consume around 90,000 tonnes more.



Gum Arabic has an international market that has been estimated at US\$300 million with projected growth of 5.4% CAGR through 2025.

Cashew gum is a complex heteropolysaccharide obtained from *Anacardium occidentale* (L.),



Cashew gum has some biological activities, such as antidiarrheal, gastroprotective, anti-inflammatory, antioxidant, antitumor, larvicidal and antimicrobial.

Final Remarks

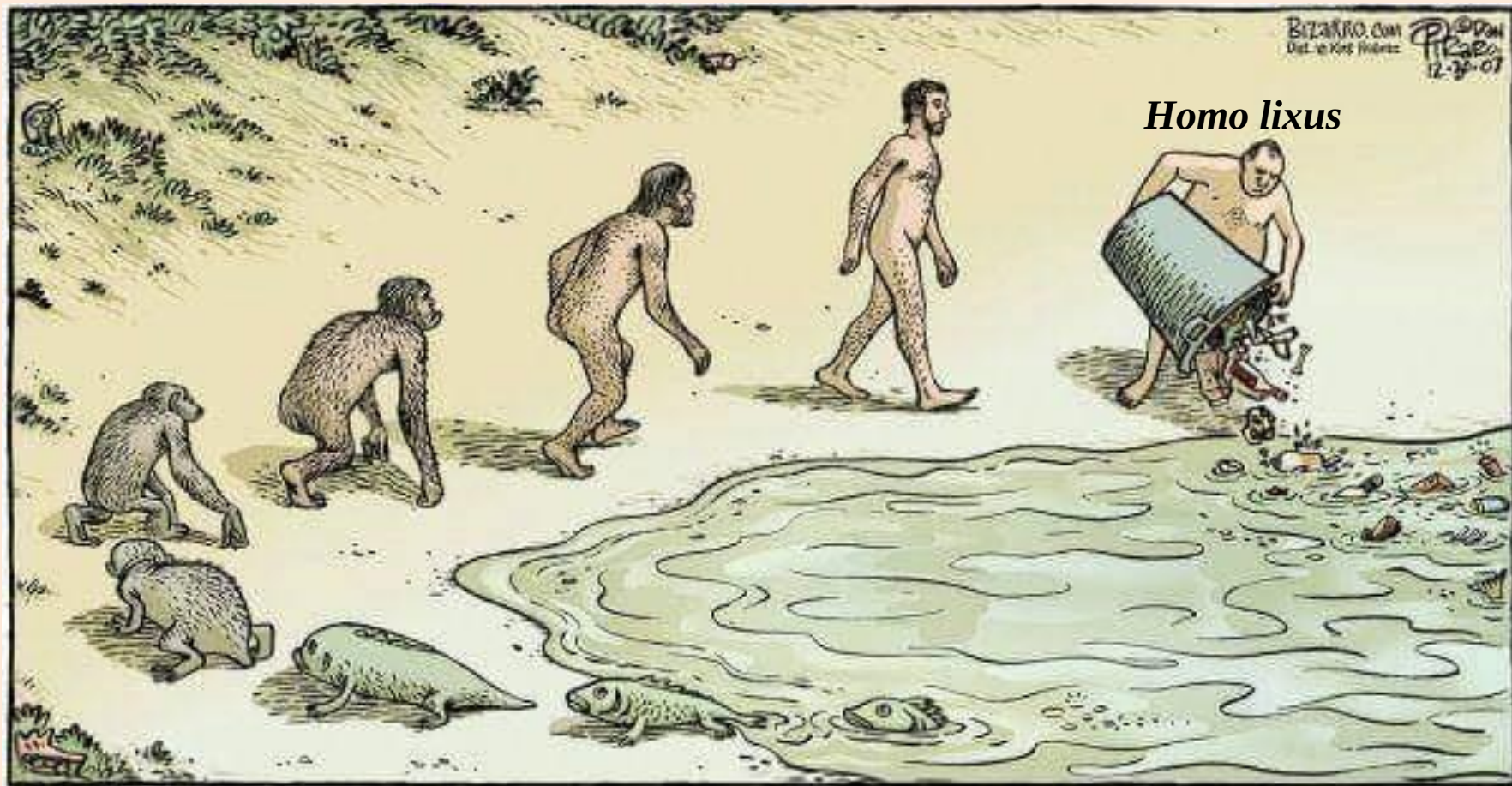
Humans occupy the same space on Earth as forests, but the relationship between these two great biological sets has not been very friendly.

A diminuição gradual das florestas está causando mudanças climáticas que levam à diversos eventos extremos.

O desaparecimento gradual das florestas irá acarretar um futuro em que os eventos climáticos serão mais graves, com mais casos de mortes e devastações nas cidades.

ALGUMAS EXPECTATIVAS PARA UM FUTURO SUSTENTAVEL

- ✓ Fome Zero.
- ✓ Qualquer produto deve ser mais durável do que o descartável.
- ✓ Incentivar a produção local (desenvolvimento econômico da região).
- ✓ Manter os mananciais aquíferos e consumir água com sabedoria.
- ✓ Zerar o desmatamento ilegal (gestão dos recursos naturais).
- ✓ Redução para metade as emissões do efeito estufa até 2030.
- ✓ Energia limpa de fonte renovável.
- ✓ Aproveitamento com responsabilidade os recursos naturais.
- ✓ Acabar com o avanço de garimpo em áreas preservadas na Amazônia.
- ✓ Redução das desigualdades sociais.
- ✓ Tratar e reciclar os resíduos sólidos.
- ✓ Ter em mente a importância da educação ambiental.
- ✓ Evitar o uso de pesticidas agrícolas (agricultura sustentável).
- ✓ Alcançar cidades e comunidades sustentáveis. etc.....



Homo lixus

O Homem é parte da natureza e a sua guerra contra a natureza é, inevitavelmente, uma guerra contra si mesmo. **Rachel Carson**

O que a vida te apresenta, muitas vezes não é o ideal, mas é o possível. No entanto, ela lhe dá a oportunidade de você escrever uma nova linha na história.

OBRIGADO

