



Ecosystems

Models

- Text: Perplexity
- Image: Dall-E
- Audio: Eleven Labs

```
#Generate facts about different ecosystems using perplexity
def generate_facts(text: str):
    API_KEY = os.environ.get("PERPLEXITY_API_KEY")
    client = OpenAI(api_key=API_KEY, base_url="https://api.perplexity.ai")
    messages = [
        {
            "role": "system",
            "content": (
                "Be precise and very concise."
            ),
        },
        {
            "role": "user",
            "content": (
                text
            ),
        },
    ]
    response = client.chat.completions.create(
        model="llama-3.1-sonar-small-128k-online",
        messages=messages,
    )
    message_content = response.choices[0].message.content
    print(message_content)
```

```
#Generate images using DallE3
def generate_images(text: str):
    client = OpenAI()
    response = client.images.generate(
        model="dall-e-3",
        prompt=text,
        size="1024x1024",
        quality="standard",
        n=1,
    )
    image_url = response.data[0].url
    print(image_url)
```

```
#Generate sounds effects using eleven labs
def generate_sound_effect(text: str, output_path: str):
    API_KEY = os.environ.get("ELEVENLABS_API_KEY")
    elevenlabs = ElevenLabs(api_key=API_KEY)
    result = elevenlabs.text_to_sound_effects.convert(
        text=text,
        duration_seconds=22,
        prompt_influence=0.3,
    )
    with open(output_path, "wb") as f:
        for chunk in result:
            f.write(chunk)
    print(f"Audio saved to {output_path}")
```

Rainforest



Rainforest Ecosystem

1. Location and Distribution:

****Tropical Rainforests:**** Found near the equator, including the Amazon Basin, Congo Basin, and Southeast Asia[1][2][4].

****Temperate Rainforests:**** Located in cooler coastal areas, such as the Pacific Northwest in North America and parts of Japan[4][5].

2. Rainfall:

****Tropical Rainforests:**** Receive at least 80 inches (200 cm) of rain per year, with some areas receiving up to 10,000 mm (394 inches) annually[1][5].

3. Canopy Structure:

****Emergent Layer:**** Contains the tallest trees, often reaching heights of 75 meters (250 feet) or more[2][5].

****Canopy Layer:**** A dense layer of branches and leaves formed by closely spaced trees, home to about 50% of all plant species[1][2]

****Understory Layer:**** Composed of smaller trees, vines, ferns, and palms, which receive less sunlight and rainfall[2][5].

****Forest Floor:**** Covered with wet leaves and leaf litter, where few plants thrive due to lack of sunlight but supports a rich microbial community[2][5].



Biodiversity

Common Plants:

Vines, palm trees, orchids, ferns, and epiphytes like bromeliads and orchids[1][5].

Common Animals:

****Mammals:**** Jaguars, jaguarundis, sloths, monkeys (capuchin, spider monkeys), and Kermode bears[2][3].

****Birds:**** Macaws, parrots, toucans, and eagles[3].

****Reptiles:**** Anacondas, boas, and various species of snakes and lizards[2][3].

****Insects:**** Butterflies (over 1,300 species in a single park in Peru), beetles, ants, and many other insects[4].

****Fish:**** Over 5,600 species in the Amazon Basin alone[1].



Aquatic



Aquatic Ecosystems

1. Location and Coverage:

Aquatic ecosystems cover more than 70% of Earth's surface, including oceans, lakes, rivers, and wetlands[1][2][5].

2. Types:

****Marine Ecosystems:**** Located in oceans and seas, characterized by saltwater, and home to a wide variety of organisms from tiny plankton to huge whales[1][2][5].

****Freshwater Ecosystems:**** Characterized by non-saline water, covering less than 1% of Earth's surface, and home to many vulnerable species of plants and animals, including 41% of all species of fish[1][2][5].

3. Subcategories:

****Lotic Ecosystems:**** Rapidly flowing water, including rivers and streams, supporting organisms like insects, fish, crayfish, and mammals such as river dolphins and otters[2][4][5].

****Lentic Ecosystems:**** Still water, including lakes and ponds, supporting plants like water lilies and algae, and animals such as frogs, snakes, and many invertebrates[2][4][5].

****Wetland Ecosystems:**** Areas with shallow water and saturated soils, including marshes, bogs, and swamps, supporting organisms like sphagnum moss, black spruce, tamarack, sedges, insects, reptiles, and amphibians[1][2][5].

4. Functions:

Aquatic ecosystems perform important environmental functions such as recycling nutrients, purifying water, attenuating floods, and recharging groundwater[2][3][5].



Biodiversity

Common Plants:

****Marine Plants:**** Mangroves, Coral, Kelp, Seagrasses, Algae

****Freshwater Plants:**** Water lilies, Algae, Rooted or floating vascular plants

Common Animals:

****Marine Animals:**** Whales, Sharks, Tube worms, Crustaceans, Shellfish, Marine mammals and seabird

****Freshwater Animals:**** Fish (including trout and eel), Insects (such as beetles and mayflies), Crayfish, Mollusks, Frogs, Turtles, Beavers, Herons and egrets



Desert



Desert Ecosystems

1. Types of Deserts:

****Hot Deserts:**** Extremely hot and dry, with low vegetation. Examples include the Sahara Desert and the Mojave Desert.

****Cold Deserts:**** Extremely cold and dry, with sparse vegetation. Examples include the Gobi Desert and the Antarctic Desert[1][5].

2. Adaptations:

****Plants:**** Many desert plants have shallow, wide-spreading root systems to quickly absorb water and store it in their cells[3].

****Animals:**** Many desert animals are nocturnal, avoiding the heat by resting in scarce shade or burrows during the day[3].

5. Unique Features:

****Oases:**** Areas with water and vegetation, often found along riverbanks or in other isolated spots within deserts[3].

****Nomadic Cultures:**** In some deserts, nomadic cultures have developed to move frequently with their flocks to find water and grazing land[3].



Biodiversity

Vegetation:

****Cacti:**** Store water in their stems and have spines to protect them from animals[3][4].

****Creosote Bush:**** Common in both hot and dry deserts, known for its ability to survive with minimal water[2][4].

****Saguaro Cactus:**** Found in the Sonoran Desert, it can store hundreds of liters of water in its trunk and branches[3].

Animals:

****Camels:**** Domesticated animals well adapted to hot deserts, capable of conserving water[2][4].

****Reptiles:**** Snakes and lizards are common, often cold-blooded and adapted to the desert environment[3][4].

****Mammals:**** Kangaroo rats and kit foxes are examples of desert mammals, with adaptations like long ears for heat dissipation[3][4].



Arctic





Arctic Ecosystems

Geographic and Climatic Context

The Arctic is defined by the area within the Arctic Circle, approximately 66.5° north of the Equator, and includes the Arctic Ocean basin and parts of Scandinavia, Russia, Canada, Greenland, and Alaska[2][4][5]

Marine Ecosystem

The Arctic Ocean is the shallowest and least salty of the world's five ocean basins, due to low evaporation and significant influxes of freshwater from rivers and glaciers.

Terrestrial Ecosystems

Terrestrial ecosystems in the Arctic include polar deserts, alpine tundra, shrublands, and boreal forests. Vegetation is mostly limited to grasses, sedges, mosses, and lichens that can survive under snow and ice for much of the year[2][3].

Freshwater Ecosystems

Large river systems, such as the Noatak and Kobuk rivers, play crucial roles in transporting carbon, nutrients, and trace metals. These rivers support anadromous fish, birds, and large mammals during their migrations[3].

Biodiversity

Marine Life

Phytoplankton and Ice Algae

Zooplankton

Polar

bears, walruses, seals, and various whale species such as bowhead whales and narwhals

****Tundra Vegetation**:** Comprises perennial forbs, dwarf shrubs, grasses, lichens, and mosses.

****Land Mammals**:** Reindeer, caribou, and other terrestrial mammals that have adapted to the Arctic environment.



Grassland



Grassland Ecosystems

Types of Grasslands

Temperate Grasslands

Location

Temperate grasslands are found in regions such as central North America (prairies), Southeast South America (pampas), and across a broad band from Ukraine to China. They generally lie between deserts and temperate forests[2][3][4].

Climate

Temperate grasslands have a climate with hot summers and cold winters. The rainfall is moderate, influencing the height of the grasses, with taller grasses in wetter regions.

Tropical Grasslands

Location

Tropical grasslands or savannas are found in regions such as northern Australia, sub-Saharan Africa, parts of Asia, and South America.

Climate



Savannas have a warm climate with distinct rainy and dry seasons. The rainfall is variable, ranging from 10 to 40 inches per year, and is often concentrated in a few months. Temperatures can vary widely, from below freezing to above 90 degrees Fahrenheit[1][4].

Biodiversity

****Grasses**:** Such as blue grama, buffalo grass, galleta, red fescue, and common bent[1][2][5].

****Wildflowers**:** Including meadow buttercup, cowslip, oxeye daisy, yarrow, and milkweed[1][2][5]

****Large Herbivores**:** Zebras, wildebeest, gazelles, and giraffes in African savannas[2]. Pronghorns, white-tailed deer, and antelopes in North American prairies[1][2]

****Small Mammals**:** Prairie dogs, badgers, coyotes, and swift foxes in temperate grasslands[2]

Amphibians and Reptiles:** Frogs, newts, and water voles in floodplain grasslands[1]. Snakes, lizards, and turtles in various grassland types[2].



Forest



Forest Ecosystems

Types and Distribution of Forests

****Taiga or Boreal Forests**:** Dominated by conifers like pines, spruces, and larches, these forests are found in the Northern Hemisphere and have prolonged winters and moderate rainfall[1]

****Monsoon Forests**:** Deciduous forests in tropical areas with a long dry season followed by an intense rainy season[1]. ****Temperate Deciduous Forests**:** Found in lower latitudes of the Southern Hemisphere, these forests have a mix of deciduous and coniferous trees[1].

Other Facts

****Climate Regulation**:** Forests combat the greenhouse effect by storing carbon and can even weaken or prevent hurricanes by breaking strong winds[3][4].

****Coastal Protection**:** Mangrove forests protect coasts from erosion and serve as nurseries for marine life[3].



Biodiversity

#Mammals

Squirrels, Black Bears, Deer,

Gorillas: Primarily on the forest floor in rainforests like those in the Congo[2].

Koalas: High up in trees, particularly in eucalyptus forests of Australia[2].

Tapirs: Found in various forest types, including rainforests and temperate forests[1][3].

Birds

Woodpeckers, Harpy Eagles, Parrots

Reptiles and Amphibians

Poison Dart Frogs, Emerald Tree Boas, Forest Cobras

Insects

Beetles, Butterflies, Ants

