

爱上科学

Science

名校教师审读 · 权威科普机构推荐



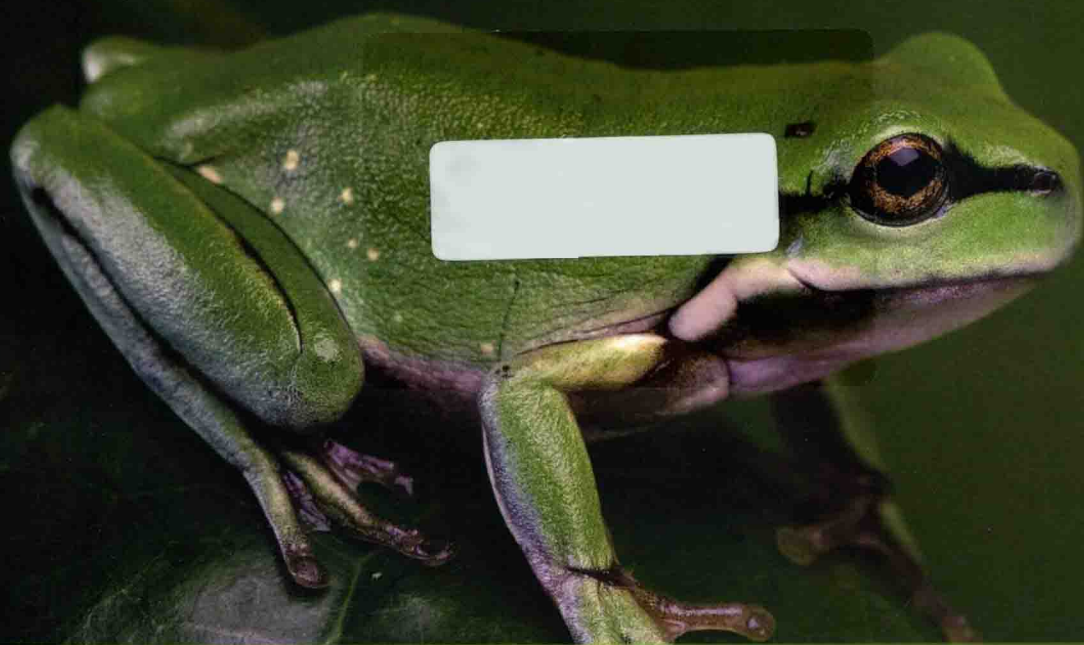
爱上科学

INTRODUCING • 生物系列
BIOLOGY

微妙的生态

ECOLOGY 双语版

[英] Sarah Eason 编
孙天予 译
李晓丹 杨海燕 审



人民邮电出版社
POSTS & TELECOM PRESS

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内容提要

《爱上科学》系列科普丛书为读者全面地讲述了科学知识和原理，以通俗的文字、生动的图表为特色，每本书介绍一个或几个主题。从日常生活中有趣的现象出发，引导和培养读者学习的兴趣，扩宽读者的视野，同时还可以帮助读者学习英语词汇、练习英语阅读。丛书涵盖物理、化学、生物、科技与发明这4个系列。适合对科学知识感兴趣的广大爱好者阅读。

本书是生物系列中的一本。生物系列主要阐释生命科学的基本概念，并探讨有关生物学的现代思想的各个方面，包括植物学、微生物学、动物与人类、遗传学、细胞生物学以及生命形式等。

本书主要讲述生物与环境之间错综复杂的关系，以及它们之间存在的微妙的平衡，并且清晰地为读者阐释了气候变化和人类的活动如何影响到生态系统。书中含有“科学词汇”栏目，提取每章重点知识词汇。同时还有“试一试”栏目，包含丰富有趣的家庭小实验，提高大家的动手能力。

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丛书序

这是一个科技新时代，我们曾经认为遥不可及的科学，时刻围绕在我们身边。你是否曾经怀疑过所谓的“2012，世界末日”，或者好奇过在地下高速飞驰的地铁，抑或每天都在关注着PM2.5……这说明科学已然走进了你的生活。学习科学，分享科学，爱上科学，让我们共同聆听来自科学的声音。

《爱上科学》系列科普丛书是一套引进版系列科普丛书，译自英国大型出版商棕熊图书（BROWN BEAR BOOKS）有限公司出版的著名科普图书《Facts at Your Fingertips》，其独特的科学解读视角、生动的科普画面、优美的图文设计，得到了欧洲读者的青睐，尤其是得到了欧洲青少年的极大欢迎。本丛书为读者全面地讲述了各个领域的基础科学知识和基本事实，以精彩的主题、通俗的文字、生动的画面为特色，从我们身边的素材和现象出发，激发和培养读者学习的兴趣。

丛书涵盖物理、化学、生物、科技与发明四大系列。物理系列阐释和说明了物理学知识及其发展史，包含对物理学发展史许多重大的物理发现以及著名的物理学家的介绍。化学系列主要阐释现代化学的基本概念，涵盖化学反应、有机化学、生物化学、金属、非金属、分子、原子、物态等多方面内容。生物系列主要阐释生命科学的基本概念，并探讨有关生物学的各个方面，包括植物学、微生物学、动物和人类、遗传学、细胞生物学以及生命形式等。科技与发明系列主要介绍各种科技成果以及相关发明，覆盖多个领域，包括建筑、交通、医学、军事、能源以及航空航天等，指导读者认知和学习各种科学技术，拓宽视野，引发思考，提升创新能力以及发明意识。

本丛书还具有中英双语的独特设计，让读者在阅读中文时，能对照性地阅读英语原文，为他们提高科学领域的英文阅读能力以及扩展科学类英语词汇量提供了很好的帮助。

丛书中还有“试一试”栏目，该栏目包含了丰富有趣的家庭小实验，为大家在生活实践中验证科学知识提供了更多的选择。

学无止境，让我们一起爱上科学！

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WHAT IS ECOLOGY?

Ecology is about the pattern of nature—it is the study of the many interactions among living organisms and their environment.

Every living thing depends on other things for its survival. House sparrows living in a park have to find seeds to eat. The seeds come from plants that must find places to grow. Sparrows feed on insects too, and the insects need plants to eat. Sparrows also need air to breathe, water to drink, and places to lay eggs. So each sparrow is at the center of a web of relationships involving other living things and its surroundings, or environment. Ecology is the science that studies these types of relationships. Instead of concentrating only on a sparrow, ecologists study how it interacts with other organisms and its environment.

Many caterpillars eat leaves, and many birds then eat the caterpillars. This link between leaf, caterpillar, and bird forms a food chain.

Food chains and webs

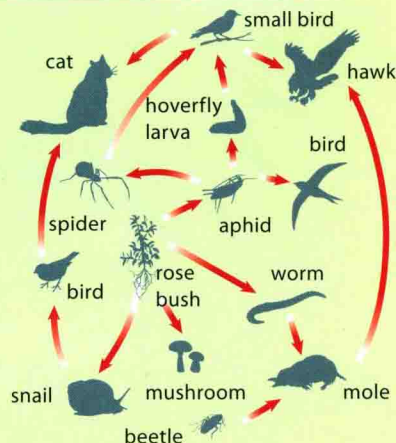
One of the most basic ideas in ecology is the food chain. Green plants make food from water, sunlight, and a gas called carbon dioxide (in the air) by a process called **photosynthesis**. Animals cannot do this, so they must eat other living organisms to get their food.

Caterpillars eat leaves and turn them into caterpillar flesh. In a simple food chain other animals, such as small birds, eat the caterpillars, and the birds themselves may be eaten by cats. However, the caterpillars are also eaten by other insects. Thus most food chains are not so simple. Several linked chains make up a **food web**.

FOOD WEBS

This diagram shows a food web based on the plants and trees in a small forest. A food web is much more complicated than a simple food chain, in which each plant or animal provides food for just one other animal. The plants provide food for many insects, worms, and other small animals, which in turn provide food for larger animals, such as cats, moles, and many different types of birds.

➔ energy flow from prey to predator





TRY THIS

Compile a Food Web

Make a list of all the animals that live in your backyard or in a local park. Remember to include insects and other minibeasts, and all the animals with fur, feathers, or scales. Check out the animals in a book to see what they eat. Then try to arrange them in a food web like the one shown on page 2. Be warned—it might get complicated!

Habitats and niches

All animals, plants, and other living organisms struggle to survive. Many organisms die, and only the best adapted live long enough to reproduce. This process is called **natural selection**, the basis of evolution. What does “fittest” mean? That depends on the environment. A goldfish can survive very well in a pond, but it would die in a desert. A lizard can live in a desert, but it would freeze in the Arctic.

Even if an animal or plant survives, it may not do as well as its neighbors. So over time it is crowded out. Every living organism

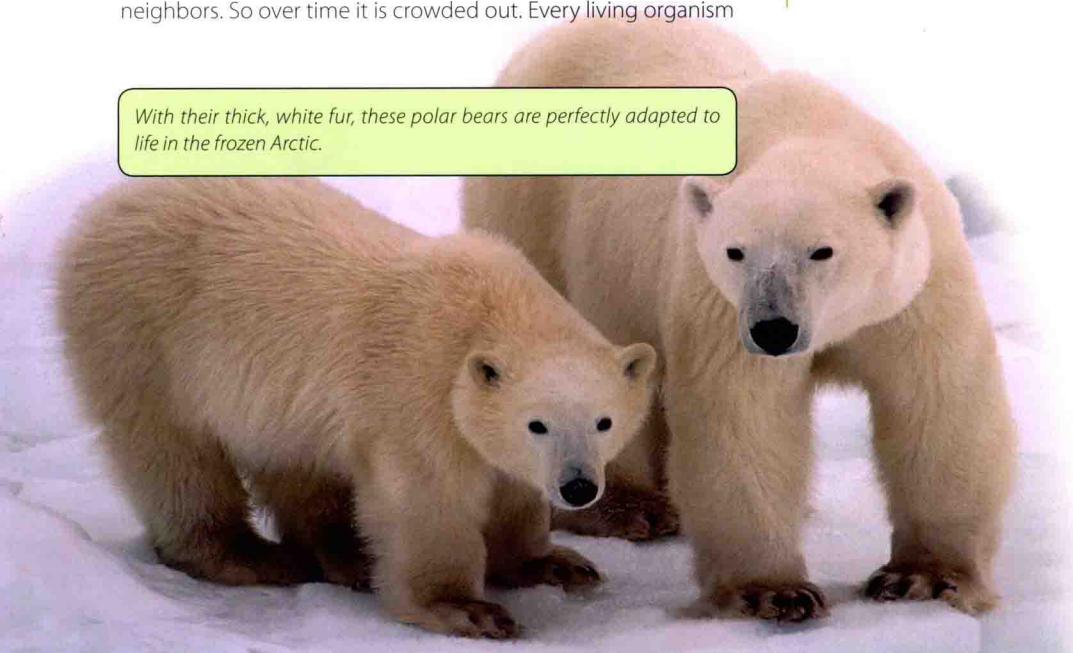
has characteristics, or adaptations, that make them suited to their environment. The place in which an animal or plant lives is called its **habitat**.

A habitat could be a rocky seashore or a tropical forest. Such places offer all kinds of ways in which animals and plants can live. Every **species** of living organism has its own special way of surviving in its habitat, and that is called its **niche**. For example, some birds specialize in eating large fruits, while others feed on small insects. The two types of birds occupy different niches.

Population to community

A niche can be occupied by just one species. A small lake may have only enough food for one big predatory fish, such as a pike, but a large lake contains enough food for several pike, and they form a population. All the animals in a population are of the same species and occupy the same ecological niche. They share their lives with other populations of different animals and plants, and together these interacting populations form a **community**. So the fish, insects, birds, and plants that live in or around a lake make up a community.

With their thick, white fur, these polar bears are perfectly adapted to life in the frozen Arctic.



什么是生态学?

生态学讲述了大自然的运行模式——它探究的是生物与它们周围环境之间的种种联系。

生命个体的生存离不开其他物质的支持。公园里的麻雀要不停地寻找植物的种子以作食物。提供种子的植物必须有一片赖以生存的土地。麻雀有时会啄食一些昆虫，而昆虫也需要以植物为食。除了食物，麻雀还需要呼吸空气、喝水，以及在适宜的地方产卵。所以，围绕每只麻雀我们都能编织出一张由它和它周围的生物与非生物环境共同组成的关系网。生态学就是一门探究上述关系的科学。生态学家们并不只把目光聚焦在麻雀身上，而是研究麻雀如何与它周围的生物和非生物环境互动。

许多毛虫吃树叶，许多鸟儿吃毛虫。这一树叶、毛虫、鸟儿间的单向联系形成了一个食物链。

食物链和食物网

食物链是生态学中最基本的概念之一。绿色植物通过一种叫作**光合作用**的生理过程利用水、阳光和（空气中的）二氧化碳为自己制造食物。动物无法做到这一点，因此动物必须以其生物为食。

毛虫啃食植物的叶片以供成长所需。在一个简单的食物链中，其他的动物，如小鸟，吃掉了毛虫，而小鸟本身又可能成为了猫的腹中餐。然而，吃掉毛虫的也可能是其他昆虫。有鉴于此，大多数食物链没有我们之前所描述的那样简单。若干条食物链相互连接，则构成**食物网**。

食物网

本图展示的食物网以一片小树林中的草木为基础。一张食物网比一条食物链要复杂得多。食物链中的一种动物或植物只作为一种其他动物的食物，而食物网中的植物同时为多种昆虫、蠕虫和其他小动物提供食物。上述的各种动物又成为猫、鼯鼠和各种不同鸟类等稍大动物的食物。

→ 能量从被捕食者向捕食者流动





试一试

画出一个食物网

列出一张你家后院或附近公园中所有动物的清单。记得把昆虫、小动物和所有具有皮毛、羽毛、鳞片的动物囊括其中。查查资料，看看这些动物以什么为食。然后试着将它们整合进一个类似第4页中所示的食物网里。注意：画出的图可能十分庞杂！

栖息地与生态位

所有的动物、植物和其他生物都在为生存而奋斗。不断地有生物个体大量死亡，只有最适应环境的个体才能活得足够久并得以繁衍后代。这一过程称为**自然选择**，这是生物进化的基础。“最适应”所代表的意义取决于环境。一条金鱼可以在池塘中欢快游动，而在沙漠中它只有死路一条。蜥蜴能够在沙漠中生活，却不能抵御北极的严寒。即使某个植物或动物个体存活了下来，它也很难在与当地

其他生物竞争的过程中胜出。因而随着时间的推移，它终将出局。每种生命体都有独特的特征和适应性，这些特质将它们与它们生存的环境紧密地联系在一起。动物或植物生活的场所被称为它们的**栖息地**。

一块栖息地可能是一片石滩或热带丛林。这些不同的地理环境造就了动物、植物的各种生存方法。每一个动物**物种**都有一套独特的且与其栖息地相适应的生存之道，称为生态位。举例来说，有些鸟类专门取食大型水果，而另一些不同物种的鸟类仅以昆虫为食，这两种鸟类便占据着不同的**生态位**。

从种群到群落

一个生态位只能由一个物种占据。一个小型湖泊提供的食物或许只能养活一条大型食肉鱼，如狗鱼，但在大湖泊中，丰富的食物可以喂饱好几条狗鱼，这些狗鱼就构成了一个种群。一个种群只由一个物种构成，并且种群中的生物共享相同的生态位。不同的动、植物构成了不同的种群。多个种群共同生活，彼此联络互动，就形成了**群落**。以湖为家的各种鱼类、昆虫、鸟类和植物组合在一起，就是一个群落。

身披厚重的白色毛皮，北极熊很好地适应了北极的严寒。



WHAT IS ECOLOGY?

Ecosystems

An ecological community can contain many organisms including plants, animals, fungi, and microorganisms, such as bacteria. These organisms share an environment that has nonliving elements, such as the **climate** (the typical weather



TRY THIS

Make Your Own Ecosystem

Create your own mini-ecosystem in a big glass jar by collecting some water from a pond in summer. Tell an adult before you go, and take care not to fall in! Fill your jar about three-quarters full. Then add some mud taken from the bottom of the pond. A layer one-to-two fingers thick should be enough. Add some water plants to produce oxygen. You can get them from the pond or at pet stores. Put your jar in a cool window, and wait for a while. The water will clear, and you may be surprised at what you see.

experienced over a year), the soil, and the location, which might be an exposed, rocky headland or a sheltered, sandy beach. A river might be slow and muddy or swift and sparkling. The possibilities are endless.

Communities of living organisms interact with their nonliving environment in all kinds of ways. These interactions often control the types of living things present in the community. For example, most riverside plants cannot grow in an estuary (where the tide mixes with freshwater) because the water is too salty. Only salt-tolerant plants can grow in estuary shallows. Along with the animals that live among them these plants form a salt-marsh community. The cycle of complex interactions between the community and its environment is called an **ecosystem**.

An alligator living in a swamp would be affected if other animals or plants were removed from its habitat.



Biomes

Any community in its environment can be called an ecosystem if it looks after itself. A small pond is an ecosystem because all the animals and plants in it get almost everything they need without leaving the water. The plants make the oxygen and food that the animals need, and in turn the animals make the nutrients and carbon dioxide that the plants need. A forest could also be seen as an ecosystem. In some parts of the world forests cover vast areas. So do grasslands, oceans, and deserts. A large geographical region that has its own distinctive climate, plants, and animals is called a **biome** and is generally made of several types of ecosystems. All the deserts on Earth form one biome; all the tropical forests form another biome.

SCIENCE WORDS

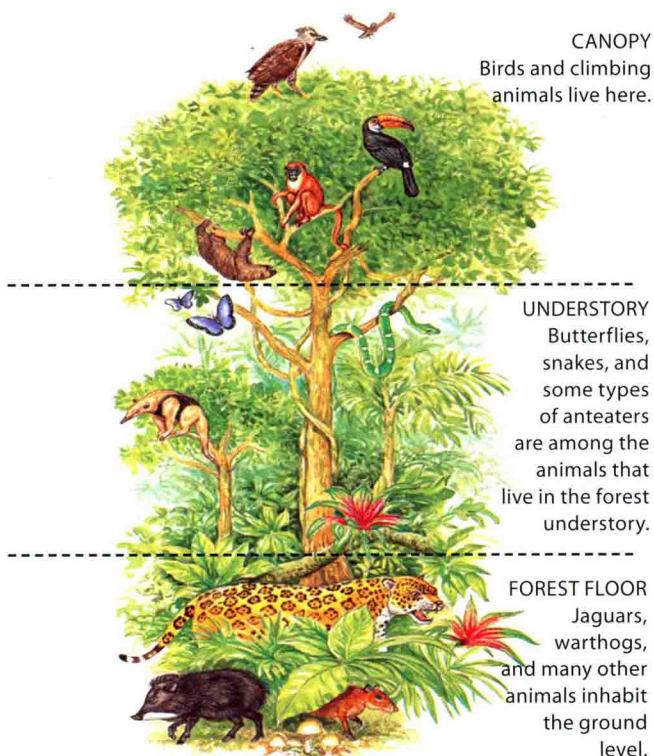
- **climate** The regular weather pattern that occurs in a certain region.
- **food chain** The passage of energy between organisms; a plant links to a herbivore, which in turn links to a carnivore. Energy is lost with each step.
- **food web** A complex series of interlinked food chains.
- **microhabitat** A small part of a habitat that sustains a community; for example, a pool in the leaves of bromeliad plants forms a microhabitat.
- **niche** The ecological role of an organism in a community.

MICROHABITATS AND COMMUNITIES

Most habitats are made up of much smaller **microhabitats**, such as the forest floor, a hole in a tree, or the different layers of a tree. A forest usually has many different types of trees, and each tree can support its own community of animals. Different communities also live at different levels of the forest. One community lives on the forest floor, another in the understory, and yet another among the branches of the forest (top **canopy**, or branchy layer). Tropical forests have two or three canopy layers. More layers produce more communities. More communities create greater **biodiversity** (range of life-forms).

Different types of animals live in different parts of the forest—from the forest floor to the branchy treetops, or top canopy.

AMAZON RAIN FOREST TREE



什么是生态学?

生态系统

一个群落中包含许多生物，有植物、动物、真菌，以及微生物，如细菌。这些生物处在一个共同的非生物环境，如**气候**（一年中的典型天气类



试一试

建立你自己的生态系统

夏季到来后，用一个玻璃水罐从附近的池塘中收集一些塘水，用它来建立你的迷你生态系统。出发前一定要向你的监护人说明你的去向，取水时小心不要落水！收集约3/4塘水，然后加入一些从池塘底部挖出的泥，大约一至两指厚即可。放入一些从池塘中取得或从宠物店购买的水草，用来制氧。把准备好的玻璃罐放在一个阴凉的窗台上，过一段时间再来观察它。水将变得清澈，你看到的景象一定能够给你带来惊喜。

型）、土壤，以及地貌，它们中或许是岩石纵横的海岬或风平浪静的沙滩。一条河流或许平滑泥泞，或许湍急清澈。非生物环境类型众多，不胜枚举。

群落中的生物与它们生存的非生物环境之间进行着各种各样的互动。这些相互作用往往决定了该地区的群落将由哪些物种构成。举例来说，大多数河岸边的植物无法在河口湾（海水与河水在此混合）存活，因为那里的水中盐分太高。只有耐盐植物才能在河口湾附近的浅滩中生长。这些植物连同生活在它们周围的动物，一同构成了一个盐沼生物群落。生物群落与非生物环境之间复杂的、周而复始的相互作用，称为一个**生态系统**。

栖息地中动物或植物的迁移会影响沼泽中鳄鱼的生活。



生物群系

任何一个可以自给自足的生物群落连同其所处的非生物环境一起，称为一个生态系统。一个池塘就是一个生态系统，池塘中的动物、植物不必离开池水，就几乎可以满足它们全部生存需求。植物制造动物所需的氧和食物，而动物则满足了植物对养料和二氧化碳的需要。一片森林也可以被看作一个生态系统。在世界上的某些地方，成片的森林覆盖着广阔的土地。草地、海洋、沙漠也都如此。我们把气候、植被、栖息动物与别处有明显区别的一大片地区称为**生物群系**。通常来说，一个生物群系中会包含不止一种生态系统。地球上所有的沙漠都属于一个生物群系；所有的热带森林来自另一个生物群系。

科学词汇

- **气候**：某一特定区域天气变化的规律。
- **食物链**：生物体之间能量流动的途径；植物与食草动物相连，后者又连向食肉动物。食物链中每个环节都伴随着能量的部分流失。
- **食物网**：食物链相互联系构成的复杂系统。
- **小环境**：一个栖息地中能够维持一个群落生存的一小部分。举例来说，一株凤梨植物叶片中的积水就是一个小环境。
- **生态位**：一个生物在群落中的生态角色。

小环境与生物群落

大多数栖息地都可以分割成较小的**小环境**，如森林底部的枯枝落叶层、某棵树上的一个树洞或一棵树上不同高度的枝叶。一片森林往往由各种不同的树木组成，每一棵树上生活的各种动物是一个完整的动物群落。如果把森林分成高度不同的层次，我们会发现不同的生物群落生活在不同的层中。一个群落在落叶层中生存，另一个群落以灌木层为家，而森林中繁茂的枝叶（**树冠层**，又叫枝叶层）又是一个群落。热带森林的树冠层还可以分为两到三层。分层越多，产生的生物群落种类越多，而更多的生物群落则创造了更丰富的**物种多样性**（生命形式的种类总数）。

不同的动物生活在森林各处——从落叶层到枝叶丛生的树梢，也就是树冠层。

亚马孙雨林中的树木

树冠层

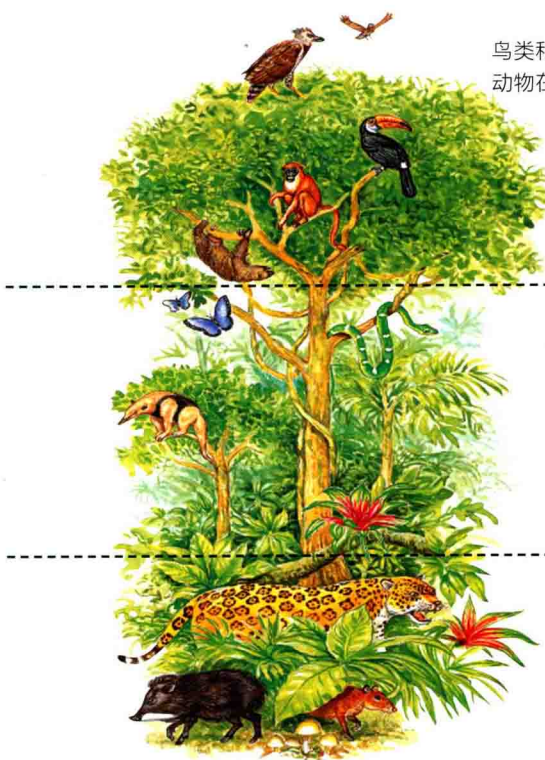
鸟类和擅长攀爬的动物在这里生活。

灌木层

灌木层出没的动物有蝴蝶、蛇和某些种类的食蚁兽等。

落叶层

美洲虎、疣猪和很多其他动物在地表层栖息。



THE DIVERSITY OF LIFE

Biologists have now identified more than 1.7 million different species (types) of living things, from microscopic bacteria to gigantic blue whales.

Most biologists, however, suspect that the true number of living organisms is many more than 1.7 million. Indeed, 10,000 new species are discovered and named each year—mostly insects and other tiny creatures.

Arranging the diversity of life into some kind of order is a task that has occupied biologists ever since Swedish botanist Carolus Linnaeus (1707–1778) introduced the basic unit for classifying life that remains in use today—the species. A species is a particular kind of living thing, such as a leopard, a date palm, or a woodchuck.

Although every individual animal or plant of a species is

different, the members of a species are more like one another than they are any other living thing. Also, they are generally only able to breed with others of the same species. To better understand the relationships between species, biologists divide species into groups, a process called **classification**.

All living things belong to one of the five kingdoms of life: plants, animals, fungi, **protists**, or bacteria. The first four kingdoms are grouped into a domain called the Eukaryota. All eukaryotes consist of cells that contain a membrane-enclosed nucleus—the nucleus contains genetic information that drives the way a cell develops. Eukaryote cells also contain miniorgans called **organelles**. Each of the organelles performs an important task for the cell.

Bacteria are classed in a separate domain, Prokaryota. A prokaryote cell contains neither a membrane-enclosed nucleus nor organelles.

Coral reefs are home to an amazing diversity of life. Coral reefs occupy less than 1 percent of the world's ocean surface, but they are home to more than 25 percent of all marine animals.