

BIODIVERSITY

(BIOLOGICAL DIVERSITY)

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INTRODUCTION

Historically, the recognition of diversity in living things is found in the writings of Sir Thomas Browne, English author and physician (1605-1682). In 1638, he wrote: "It is the common wonder of all men, how among so many million of faces, there should be none alike: now contrary, I wonder as much how there should be any. He that shall consider how many thousand several words have been carelessly and without study composed out of 24 letters; withal how many hundred lines there are to be drawn in the Fabrick of one man, shall find that this variety is necessary."¹ Biodiversity is one of the many important pillars of sustainable development.

WHAT IS BIODIVERSITY?

Biodiversity is the term used to cover the variety and variability that exist among living organisms and the ecological complexes in which they occur. It includes the entire, rich tapestry of life: the global biosphere, particular ecosystems, individual species, and genetic variation within species. Maintaining biological diversity is part of a larger environmental goal: protecting the integrity of natural ecosystems and the health of the Ecosphere as whole.²⁰

Summary of the biological diversity of wild species in Canada²⁰

Plant and animal groups	Known species	Suspected species	Principal pressures/stress
Algae and diatoms	5323	2800	Water pollution
Slime molds, fungi, and lichens	11400	3600	Atmospheric pollution
Mosses and liverworts	955	50	Habitat reduction, especially deforestation and loss of wetlands
Ferns and fern	141	15	Habitat reduction

allies			
Vascular plants (about 78% native)	4187	100	Habitat reduction
Molluscs	1121	100	Water quality changes
Crustaceans	3008	1100	Overharvesting, water pollution
Insects	33755	32800	Habitat change, biocides
Spiders, mites, and ticks	3171	7700	Habitat change, biocides
Other invertebrates	6879	5000	Habitat change, biocides
Sharks, bony fish, and lampreys	1091	513	Habitat destruction, water pollution, overharvesting
Amphibians and reptiles	83	2	Habitat destruction, acid precipitation, overharvesting
Birds	578	0	Habitat change and loss, biocides, competition from nonnative species, hunting
Mammals (excluding humans)	193	0	Habitat change and loss, hunting
Total	71895	53780	

IMPORTANCE OF BIODIVERSITY

Scientists call rain forests, dry forests, wetlands, bogs, and watersheds world's largest reservoir of genetic traits (biodiversity), largely unexploited but at the same time some have been destroyed permanently.

Farmers may someday need to fall back on wild strains of food crops to resist epidemics of disease or insect infestations. Industries may come to these places to exploit such biochemical marvels as the copaiba tree, which naturally produces a liquid with qualities like diesel fuel's. These places contain an enormous variety plants and animals. As a third of all earth's species are believed to live within these complex habitats, only a fraction of which have yet been given scientific names. In a rain forest a single acre may contain roughly ten times as many tree species as in most temperate forests; the destruction of even a small area can result in the extinction of uncounted species.

By one estimate perhaps one species a day might be disappearing in these places - many before their existence is even known, much less evaluated for possible value to human beings.

In 1985 the drought in Ethiopia farmers used seed grain and thus have broken the chain of diversity of genetic strain which evolved in last 1000 years of history (wheat, corn, and sorghum). This diversity of genetic strain is very important for the development of need seeds for the future.

The following is a partial list of cereal grains, fruits, and vegetables with the country or region of their origin:

- Flax seed - North America
- Cranberry - North America
- Blueberry - North America
- Concord Grapes - North America
- Black Walnut - North America
- Sunflower - North America
- Pecan - North America
- Pepper - South America
- Egg Plant - Southeast Asia
- Squash - Central and South America
- Cabbage - Europe
- Carrot - Central Asia
- Cucumber - Central Asia
- Onion - Central Asia
- Tomato - Mexico
- Corn - Central and South America
- Sweet Potato - Caribbeans
- Barley - Eastern Mediterranean
- Oats - Eastern Mediterranean
- Wheat - Eastern Mediterranean
- Rye - Eastern Mediterranean
- Potato - South America - Andes
- Rice - Southeast Asia
- Wild Rice - North America
- Coffee - Ethiopia
- Tea - China

Most centers of crop diversity where relatives and ancestors of the crops are still being found in the tropical regions of the world namely Asia, eastern Mediterranean, Northeast Africa, Central and South America. One of the important areas is Peruvian Andes. It is a rugged terrain, harsh unforgiving climate, and have isolated communities. Because of the harsh environment, the plants in this area tend to store energy in the tubers. When the Indians arrived in this area 10,000 or more years ago their main staple food was the tubers.

Potatoes are still their staple diet. There are thousands of varieties of potatoes grown in Peru, Thousands of varieties of rice grown in India and Southeast Asia, and thousands of varieties of wheat grown in Greece. Each variety has special characteristics. Each grows in different season of the year and each is resistant to different plant disease. This [provides communities an insurance policy against natural disaster brought about by an epidemic of particular plant disease. Recall the potato controversy in Europe and potato famine in Ireland. To preserve the diversity of potato plants, there has been established an International Potato Center in Lima, Peru.

There is a danger in the revolution of crop breeding. It tends to displace the old variety by new improved variety and hence possible loss of thousands of varieties from which new varieties are invented, possibly of new genetic variety wiping out old varieties which nature have produced by the process of evolution and natural selection. Genetic engineering is getting proficient in crossbreeding and cloning, replacing a gene by another gene but not making a new gene from raw materials, at least not yet.

The Green Revolution produced new varieties of crops and produced the yield of the crop tremendously but these new varieties are very sensitive to the climate change, rain, and requires intense chemical fertilization. For the long run chemical fertilization destroys the natural ability of the soil of providing nutrients. The United Nations Agency, Food and Agricultural Organization (FAO) has now established Seed Banks in different part of the world in order to preserve the biodiversity.

Not all drugs can be synthetically made. About 25% of the modern drugs still come from plant extracts. U.S. imports about 25 million dollars worth of plants from the rain forests of the world and produces 3 billion dollars worth of medical drugs from this import.

Very few primary chemical compounds are produced by plants. Unusual substances (with unusual molecular structure) called secondary chemical compounds are produced by plants. These are not essential to the life cycle (basic life cycle) of the plants. The role of secondary compounds is not yet clearly understood by the scientists. They may be produced by plants for their survival - being poisonous, may be for protection and defence - competition for nutrients and space. The secondary compounds are critically important for human medicine.

By making use of the modern technology like Computer Aided Design (CAD)) scientists can study a three dimensional picture of an unusual chemical compound, modify its structure, and predict its biochemical behaviour. This technique in research helps them to study new chemical compounds produced by new plant species found in the rain forest and other places.

STRATEGIES FOR CONSERVING BIODIVERSITY

Six main obstacles make it hard to conserve biological diversity:

- (1) National development programs undervalue biological resources monetarily.
- (2) Overexploitation of biological resources yields great profit for traders and manufacturers (who can externalize environmental costs) while impoverishing the local people who have few other sources of livelihood and who must pay the environmental costs of overexploitation.
- (3) The species and ecosystems upon which human survival depends are still poorly known.
- (4) Scientific research often does not meet the needs of resources and protected-area management.
- (5) Conservation activities tend to be focused too narrowly.
- (6) Institutions assigned responsibility for conserving biodiversity have lacked sufficient financial and organizational resources to do the job.

These obstacles block progress in both developed and less developed countries.

Developed countries depend on tropical resources for

- (1) industrial materials,
- (2) breeding materials,
- (3) pharmaceuticals,
- (4) tourism destinations, and
- (5) numerous other tangible and intangible benefits.

Effective action must be based on accurate information, and the more widely shared the information, the more likely it is that individuals and institutions will agree on the definition of problems and solutions.

To gain necessary knowledge, workers must

- (1) conduct taxonomic surveys to document the wealth of the area's plant and animal species;
- (2) undertake greatly expanded ecological research to determine,
 - (a) how the various pieces fit together,
 - (b) explain the population dynamics of species of particular concern,
 - (c) assess the effects of fragmentation of natural habitats, and
 - (d) determine what management steps are required to enable ecosystems to flourish with their full complements of species
- (3) develop and improve mechanisms for ex situ preservation, including both captive propagation of species and their eventual release into natural or restored ecosystems;

- (4) monitor the changes in species diversity and ecosystem function as human influence become more pervasive;
- (5) assess the ecological differences between relatively large but minimally disturbed ecosystems and ecosystems that have been heavily affected by humans to learn how to enhance productivity and restore degraded ecosystems to a more productive state; and
- (6) conduct social science research to determine how local people manage their resources and how changes in resource availability and land use affect human behaviour.

BUILDING AN URBAN WILDERNESS

Valuable wilderness areas, unique in contemporary Europe, have evolved in the city centers, and conservationists have found many reasons to work for their preservation. Among these are a number of rare and endangered species. The treasure of these wilderness areas lie in the diversity of individual ecosystems that exist side by side within small areas.

Many of the species are not native to these cities. In some cases 20 percent of the vegetation is of American, Asian, and Mediterranean origin and hitchhiked via steam engines.

The sites' uniqueness stem from the rich diversity of anthropogenic materials present. Ruins, debris, and refuse contribute to the variety of microhabitats that have given rise to beautifully adapted vegetation and fauna.

The conservationists basically wish to preserve the biological succession in these urban natural parks in the heart of the cities.

CANADA'S VANISHING WILDLIFE (PARTIAL LIST - WORLD WILDLIFE FUND, CANADA)

DEFINITIONS:

EXTINCT: No longer known to exist anywhere in the world.

EXTIRPATED: No longer known to exist in the wild in Canada.

ENDANGERED: Threatened with imminent extirpation or extinction in all or much of its Canadian range because of human action.

THREATENED: Likely to become endangered.

VULNERABLE: Particularly at risk because of low or declining numbers or for some other reason, but not threatened.

RARE: Exists in low numbers or in very restricted areas and so is vulnerable.

Animals

Extinct

1. Dawson Caribou
2. Sea Mink
3. Great Auk
4. Labrador Duck
5. Passenger Pigeon
6. Banff Longnose Dace
7. Blue Walleye
8. Deepwater Cisco
9. Longjaw Cisco

Extirpated

10. Atlantic Grey Whale
11. Atlantic Walrus
12. Black-footed Ferret
13. Swift Fox
14. Gravel Chub
15. Paddle Fish

Endangered

16. Bowhead Whale
17. Eastern Cougar
18. Eastern Wolverine
19. Right Whale
20. St. Lawrence Beluga Whale
21. Sea Otter
22. Ungava Bay Beluga Whale
23. Vancouver Island Marmot
24. Eskimo Curlew
25. Greater Prairie Chicken
26. Kirkland's Warbler
27. Mountain Plover
28. Peregrine Falcon (anatum)
29. Piping Plover
30. Spotted Owl
31. Whooping Crane
32. Leatherback Turtle
33. Acadian Whitefish
34. Aurora Trout
35. Salish Sucker

Threatened

36. Eastmain Beluga Whale
37. Maritime Woodland Caribou
38. Newfoundland Pine Marten
39. North Pacific Humpback Whale

40. Peary Caribou
41. Prairie Long-tailed Weasel
42. Wood Bison
43. Baird's Sparrow
44. Burrowing Owl
45. Ferruginous Hawk
46. Henslow's Sparrow
47. Loggerhead Shrike
48. Peregrine Falcon (tundrius)
49. Roseate Tern
50. Black Redhorse
51. Blackfin Cisco
52. Copper Redhorse
53. Great Lakes Deepwater Sculpin
54. Lake Simcoe Whitefish
55. Margined Madtom
56. Shorthead Sculpin
57. Shortjaw Cisco
58. Shortnose Cisco
59. Sowerby's Beaked Whale

Vulnerable

60. Western Wolverine
61. Northern Prairie Skink
62. Pacific Giant Salamander
63. Banded Killifish
64. Bering Wolffish
65. Bigmouth Buffalo
66. Black Buffalo
67. Blackline Prickleback
68. Fourhorn Sculpin
69. Least Darter
70. Orangespotted Sunfish
71. Redbreasted Sunfish
72. River Darter

Plants

Extirpated

73. Blue-eyed Mary

Endangered

74. Cucumber Tree
75. Eastern Mountain Avens
76. Eastern Prickly Pear Cactus
77. Furbish's Lousewort
78. Gattinger's Agalinis

79. Heart-leaved Plantain
80. Hoary Mountain Mint
81. Large Whorled Pogonia
82. Pink Coreopsis
83. Pink Milkwort
84. Skinner's Agalinis
85. Slender Bush Clover
86. Southern Maidenhair Fern
87. Small White Lady's Slipper
88. Small Whorled Pogonia
89. Spotted Wintergreen
90. Water-pennywort

Threatened

91. American Chestnut
92. American Waterwillow
93. Athabasca Thrift
94. Blue Ash
95. Bluehearts
96. Colicroot
97. Giant Helleborine
98. Ginseng
99. Golden Crest
100. Kentucky Coffee Tree
101. Mosquito Fern
102. Nodding Pogonia
103. Pitcher's Thistle
104. Plymouth Gentian
105. Purple Twayblade
106. Red Mulberry
107. Sweet Pepperbush
108. Tyrrell's Willow

Vulnerable

109. Gulf of St. Lawrence Aster

Rare Species

(Fauna and Flora)

- Black-tailed Prairie Dog
- Blue Whale
- Eastern Mole
- Fin Whale
- Fringed Myotis
- Gaspe Shrew
- Gray Fox
- Keen's Long-eared Bat

Norwest Atlantic Humpback Whale
Pallid Bat
Plains Pocket Gopher Tree
Queen Charlott's Ialands Ermine
Spotted Bat
Southern Flying Squirrel
Western Woodland Caribou
Barn Owl, Caspian Tern
Cooper's Hawk
Eastern Bluebird
Flammulated Owl
Great Gray Owl
Ipswich Sparrow
Ivory Gull, King Rail
Least Bittern
Peregrine Falcon, (pealei)
Prairie Warbler
Prothonotary Warbler
Red-shouldered Hawk
Ross's Gull
Trumpeter Swan
Fowler's Toad
Bigmouth Shiner
Blackstripe Topminnow
Brindled Madtom
Central Stoneroller
Charlotte Unarnored Stickleback
Giant Stickleback
Green Sturgeon
Kiyi
Lake Lamprey
Pacific Sardine
Pugnose Minnow
Pugnose Shiner
Redside Dace
River Redhorse
Shortnose Sturgeon
Silver Chub
Silver Shiner
Speckled Dace
Spotted Gar
Spotted Sucker
Sqanga Whitefish
Umatilla Dace
Broad Beech-fern
Dence Blazing Star

Dwarf Hackberry
Few-flowered Club-rush
Green Dragon
Hill's Pondweed
Hop tree
Indian Plantain
Lilaeopsis
Nacoun's Meadow-foam
Prairie Rose
Prairie White-fringed Orchid
Shumard Oak
Soapweed
Swamp Rose Mallow
Victorin's Water Hemlock
Western Silver-leafed Aster

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