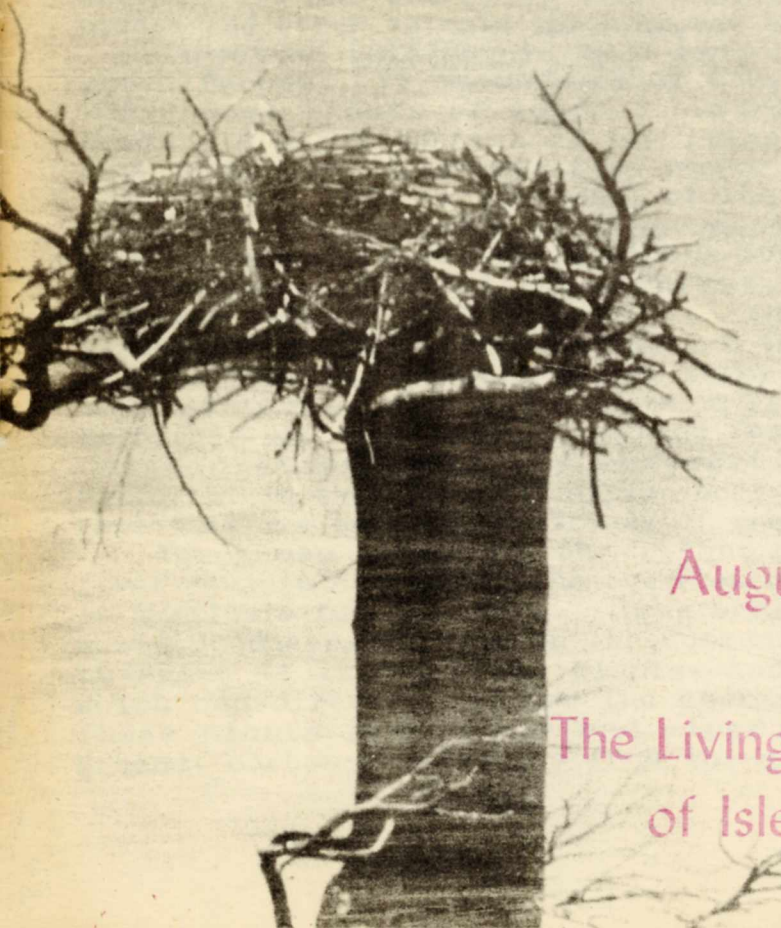




WOLF'S EYE



August 1958

The Living Community
of Isle Royale

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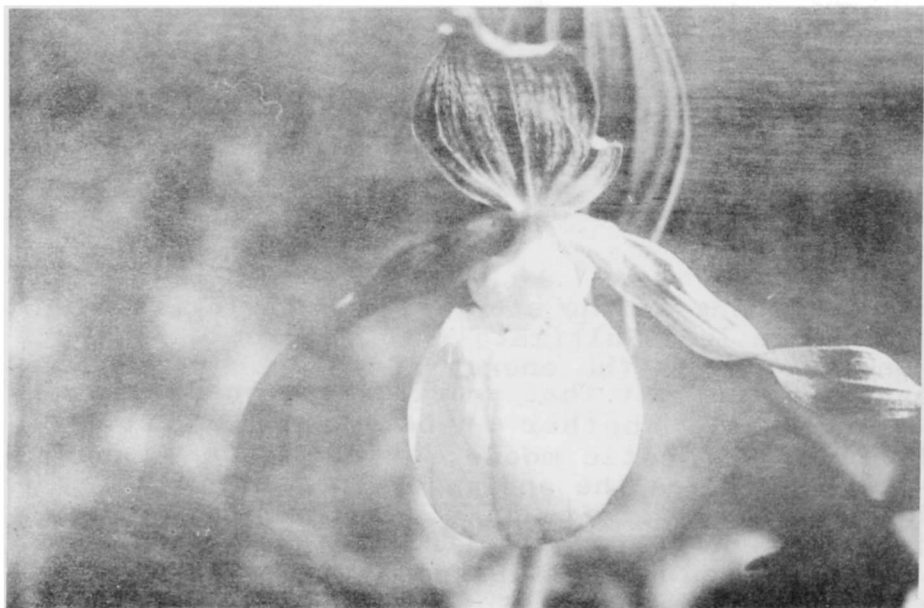
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The Living Community of Isle Royale

The beginning of the story of the living things of Isle Royale leads ultimately to the sun. In the last analysis it is the energy of the sun reaching the earth as sunlight that provides the energy, the fuel, for life. Whether it be a simple little Bunchberry, a majestic moose, or even the timber wolf--each utilizes the energy of the sun to carry on the activities of its life. Although the sun provides the energy for all life it is easy to see that not all organisms can harness the solar energy directly. We, ourselves, for example, cannot survive by merely exposing ourselves to the sun; we must obtain our energy of life indirectly through plants and other animals which we eat as food.

Carpeting Isle Royale is a luxuriant cover of green forest. It is made up of many millions of individual plants of several hundred different kinds. A major portion of the island is covered with a forest of balsam fir, white spruce, and paper birch, while a good deal of the remainder is cloaked beneath stands of sugar maple and yellow birch. These are the two dominant forest types of Isle Royale. Each of these forests has its own peculiar complex of lesser plants. Growing in the spruce-fir forest, for example, are the Pipsissewa and the Wood Lily, while in the sugar maple forest such plants as the Large White Trillium and the Mayflower are more typical. These forests are thus quite distinct in their composition and very different in their general appearance, but in either case they are made up of miriads of green plants.

The green plants of the island are nature's first step in harnessing the solar energy and making it available for life here. These organisms are the basic producers of food in the community of living things. It is the green plants--and only they--which can directly utilize the energy of the sun. These plants draw water and minerals from the ground, carbon dioxide gas from the air, and using



YELLOW LADY SLIPPER ORCHID

solar radiation as the energy source build these inert raw materials into living tissue and into food on which to sustain themselves. Of all nature's living things only the green plants deal directly with the sun and with the raw, lifeless elements of the earth. The veritable carpet of green one sees from some high point on Isle Royale such as Mt. Ojibway or Mt. Desor is composed of endless individual plants, each drawing minerals from the soil and with water, carbon dioxide, and sunlight, building an enormous reservoir of living tissue in the form of leaves, twigs, wood, fruits, berries, flowers, and so on.

There are a great many forms of life which do not have the ability to mold the raw, inert elements of the earth into the living materials of their bodies, and so in order to derive the energy for their lives it is necessary that they fall back on the reservoir of tissue built by the green plants as the source of their livelihood. The energy of the sun has already been captured for them by the green plants and they use it second hand. A very large number of Isle Royale's animals feed on plants in this way.

Many insects--for example, the long-horned beetle, the spittlebug, the aphid, the various butterflies, and the grasshopper, to mention only a few are all strict vegetarians. Of very different structure and size, and therefore, to man of seemingly far greater importance, are some of the larger animals of the island which in actuality occupy the same place in nature's community and are of no greater significance than the less spectacular insects. The Northern Red Squirrel feeds largely on the seeds of the fir and spruce and on the hazelnut and the fruit of the alder. The beaver depends upon the leaves and smaller branches of the Paper Birch and the Quaking Aspen for his food supply, but his dependence upon these trees is deeper than that of merely a source of food. The beaver builds his home and his dams from the same trees as those on which he feeds. He thus depends upon green plants for shelter as well as for food. Although less obvious in other instances, the forest is also the provider of shelter to a host of organisms--a role which in the last analysis is as vital as the role it plays as provider of food.

The moose, too, is a vegetarian feeding largely on birch, aspen, willow, and many forms of aquatic vegetation. It is quite a difficult proposition to place the majestic moose and the lowly aphid on the same plane of importance, but their places in the community of life on Isle Royale are essentially one and the same.



AN ISLE ROYALE PAPER BIRCH AND ASPEN FOREST

Just as the moose cannot survive on water, carbon dioxide, minerals, and sunlight, so many animals find it impossible to thrive and flourish on plant materials. These animals must obtain the energy for their lives third hand by eating the flesh of other animals. Such is the case with the dragonfly, an insect which feeds upon other insects, chiefly small flying forms such as the mosquito. The Common Toad and the frog are also insect feeders. There are two kinds of snakes found on Isle Royale, a small fellow called the Red-bellied Brown Snake and a larger one, the Stripped Garter Snake; both feed upon the flesh of other animals. Because he is small, the Red-bellied Snake finds that small insects do nicely as the mainstay of his diet, small flies and beetles being his chief food. The Garter Snake is much larger, however, and small insects do not serve well as a food source to meet his needs. A small beetle is a very little bit of living material on which to nourish a large body. A proportionately large amount of energy would have to be expended in the capture of a small insect, and in the case of the Garter Snake the prey would probably not yield as much energy as food as was burned up in the process of capturing it. Therefore, the larger flesh-eaters must concentrate their efforts on catching larger prey. The Garter Snake finds that large beetles or even toads and frogs are a more suitable source of food for they are large enough to provide him with the energy he needs to live.

It is easy to see how a chain of food and feeder exists--each link of the chain being dependent on the link before and forming the basis of survival for the link above. We began with the sun, the ultimate source of energy; we then considered the green plants and the insects which feed on them; then we saw that the frog and the toad feed upon the insects, and in turn were fed upon by the larger snakes. There are many such chains of food and feeder to be found on Isle Royale. Another one begins with the sun and green plants and develops through the Snowshoe Rabbit which feeds upon the plants, and ends with the Red Fox, the Coyote, or the Timber Wolf which prey upon the rabbit. In still another example, the energy of the sun,



LOON



STRIPED GARTER SNAKE

harnessed in the tissues of a green plant is fed upon by the White-footed Mouse, which in turn is fed upon by a host of animals such as the Bald Eagle, the weasel, and the Screech Owl. The many food chains which exist on Isle Royale, and there are a great many, are not at all independent from one another. One animal or plant may fit into a great many chains. The Timber Wolf, for example, is the final animal in a score of food chains--feeding on mice, rabbits, snakes, and even moose. Many plants, too, are fed upon by a great variety of animals. And so the untold numbers of food chains merge to form a complex web of life on Isle Royale.

It is a great simplification of the truth to consider all animals either vegetarians or flesh-eaters--a great many are both. The Herring Gull as a case in point eats almost anything, and the Red Fox, while preferring mice, toads, snakes, and the like, will do very nicely on nuts and berries when animal life is scarce. Thus, the various food and feeder relationships which exist upon the island are not always as straight forward as one would believe. Indeed, things often become quite complex.

In the bogs of Isle Royale grow two plants--the Pitcher plant and the Sundew. These plants are, at least in part, flesh-"eaters", and derive a portion of their food by trapping and capturing insects. Then too, not all plants can manufacture their own food as can the green plants, and they must grow in soil where other life has preceeded them and where the tissues of these previous organisms are still available as food. The Indian Pipe or Ghost-flower, as well as the many mushrooms and toadstools, are forms of life of this sort.

The living things of Isle Royale exist not alone and apart from one another -- each living its own separate life -- but they exist as members of a complex web of life where plant and animal depend upon one another for food and shelter and where the welfare of one organism is inseparably intertwined with that of another. How foolish it is, for example, to consider the moose as independent from the community of living things in which it lives. The forest plants provide its food and shelter -- it cannot live without them. The wolf as well as many disease organisms such as the bacteria, feed upon the moose, and thus, are a very important part of its existence. In fact, if the wolf or disease did not kill a certain number of moose, the moose population would grow and eventually the forest would suffer due to the increased feeding upon it by the moose.



RED FOX

The wolf is not the villain -- there is no hero nor villain in nature's scheme -- for every living thing has its proper place and rôle and each contributes its part to the balance and stability of the whole.

The great variety of living things and the strange array of foods, shelters, and habits, which allow every conceivable portion of the Earth's potential to be used creates on Isle Royale this giant web of life, the strands of which are so many and so interwoven that the human observer can have but the barest inkling of its full complexity and significance.

One might ask, "how did all this complex of plant and animal life arrive on Isle Royale in the first place". Naturally, this becomes so complicated that no one person could give a very detailed answer, but a lot is known about it and several theories have been developed to cover most situations.

About 10,000 years ago, the area now occupied by Lake Superior was covered by a sheet of ice which ranged to about ½-mile in thickness. This, of course, was a tremendous amount of ice. Between 7,000 and 10,000 years ago, the climate of this area (as well as over the entire Earth) became warmer and the great ice age drew to a close. The melting of all this ice released enormous amounts of water which filled the area now occupied by Lakes Superior, Huron and Michigan. It is estimated that the water level of this huge lake (known as Lake Algonquin) was 700 feet higher than the present level of Lake Superior. Isle Royale, then, consisted of only the points along the Greenstone Ridge high enough to pierce this very high water level.

The period of high water level in the Great Lakes began to change, however. New outlets from the lakes were formed to the East and North and the great amount of water being released from the melting glaciers became less and less and over many hundreds of years, the lakes attained their present level -- not gradually nor all at once, but by successive more-or-less sudden drops.

At a time when the glaciers had melted northward -- say, for example, to about 200 miles north of Isle Royale -- the climate in this area was still quite cool and moist. But glaciers were not only in this area; they extended over a great deal of North America. We might suppose that the moist-cool climate was not only in this area, but everywhere in North America just south of the melting glaciers. Then we might also suppose that plants and animals that are adapted to living in a cool-moist climate would enter not only this area, but the entire area just south of the melting ice. Because of this fact, much of the forest life which lived in this region

was the same as that in New England or in the Pacific Northwest. The major forest species involved in this moist-cool climatic habitat were spruce, fir, birch and aspen -- still present today on Isle Royale. Just how the seeds for these plants arrived on Isle Royale is a matter for much speculation. Wind may have carried seed to the island, or some seeds could have floated over on the water's surface, or have been carried by birds.

Between 1,000 and 3,000 years ago, the Earth's climate was much warmer and drier than before or since. It was during this period of history when the Viking people colonized Iceland and southern Greenland, for example, where farm crops and dairy cattle were raised. In North America those forest types which we think of as central-southern were able to live much further north. Oaks, hickories, sugar maple, red maple, yellow birch and others became established at Isle Royale during this time because the climate was warm and dry enough to permit them to live here. The spruce, fir, paper birch and aspen remained at Isle Royale during this warm-dry period, but their numbers decreased substantially.



A MATURE PAPER BIRCH-ASPEN FOREST NEAR SISKIYOU BAY. BECAUSE THE TREES ARE LEAFLESS IN THIS WINTER PHOTOGRAPH, YOU CAN SEE THE SPRUCE AND FIR TREES IN THE UNDERSTORY WHICH WILL SOMEDAY GROW TO MATURITY. THE BIRCH AND ASPEN WILL THEN NEARLY DISAPPEAR FROM THE CLIMAX FOREST.



MUCH OF NORTHEASTERN ISLE ROYALE IS CLOTHED WITH A SPRUCE-FIR FOREST LIKE THIS ONE NEAR THE OLD ROCK HARBOR LIGHTHOUSE. THE TALLEST TREES ARE THE MATURE SPRUCES AND THE DECIDUOUS TREES ARE MOSTLY PAPER BIRCH. THE AREA WAS BURNED-OVER ABOUT 100 YEARS AGO AND CONTAINS MANY OF THE BIRCHES THAT CAME IN AS PIONEER TREES AFTER THE FIRE. IN YEARS TO COME THE BIRCHES WILL BECOME FEWER AND FEWER UNTIL MOSTLY ONLY SPRUCE AND FIR TREES ARE LEFT.

Further west -- in the Dakotas, for example -- it became so dry that many species ceased to live there. Hence, today, some plants such as the Devil's Club or Thimbleberry live on Isle Royale and also in the northwestern United States, but ceased to live in the northern prairie states where they may have lived at one time when the glacial border was not too far to the north.

Since 1000 years ago the Earth's climate has become somewhat cooler and more moist. Once again, Spruce, Fir, Paper Birch, and Aspen form the most extensive forest type on Isle Royale. The Sugar Maple, Yellow Birch and Northern Red Oak which came here in the warm-dry period still remain, however, on the south-facing slopes of the interior ridge section. The influence of Lake Superior which is so very cold, is not so clearly felt on these inland slopes. Also, the summer sun is almost at right-angles with the south-facing slopes which further warms and dries the climate of the interior ridges, producing a very favorable habitat for the hardwoods. The most abundant tree species of the interior-upland forest is the sugar maple which forms a very luxuriant forest of about 13 square miles in area.

After the great glacial age, and after the waters of the great glacial lakes began to subside, the bare rocks of Isle Royale became exposed to the air. Very likely the first plants to inhabit this hostile environment were the lichens. At the same time, the rock surfaces "weather" and small cracks form into which particles of "weathering" rock, pieces of lichen and so forth accumulate. This accumulation is the beginning of soil formation and eventually small plants -- such as the 3-leaved cinquefoil -- will begin to grow in the crevices. As these small plants develop to maturity and die, their bodies, too, are added to the developing soil. More and more soil is formed in this way making a habitat suitable for the growth of more and more plants. Time -- much time -- passes, and finally enough soil has been formed which is capable of containing enough moisture to support a forest growth.

The first trees to enter the newly-formed habitat are the "pioneer" trees. Where enough moisture is present the pioneer trees on Isle Royale are the paper birch and aspen. The trees grow to maturity, casting their shadows on the forest floor beneath. In so doing the habitat is again changed; it is now shaded instead of receiving the brilliant summer sun. The seedlings of pioneer trees do not find this shaded habitat as suitable as the open sunlight and they often do not live for long. However, other tree seedlings find this shaded area to their liking -- the white spruce and balsam fir thrive on the cool, moist, shaded forest floor. The spruce and the fir also grow to maturity and their offspring follow -- giving a continuous stand of spruce and fir until such time as fire, wind, or man may destroy it. This is called the "climax" forest -- trees which are adapted to their environment of temperature, moisture, soil, light, browsing animals and so on.

Not all of Isle Royale, however, contains a climax forest of spruce and fir. Where there is not sufficient moisture and coolness, the pioneer trees may turn out to be northern red oak and white pine rather than paper birch and aspen. The climax forest species which grow in the shade of the oak and pine are sugar maple and yellow birch instead of spruce and fir. This climax forest has its greatest development on Sugar Mountain, Mount Desor and other parts of the Greenstone Ridge and Red Oak Ridge on southwestern Isle Royale. Probably the maple forest will extend all along the Greenstone Ridge northeastward to Mount Ojibway when this area recovers from the several fires which have occurred during the past 100 years.



THE SUGAR MAPLE-YELLOW BIRCH FOREST ON THE SOUTH-FACING SLOPE OF SUGAR MOUNTAIN

cool and moist -- and lives today in the cool, moist places on the island. The sugar maple-yellow birch forest arrived during the warm-dry period of time (1,000 to 3,000 years ago) when Isle Royale became suitable for its growth and remains today in the warm-dry interior section of the island.

Each of these forests is complex: the plants and animals that live in them are those which are suited to all the complexities of moisture, temperature, seasonal variation, light, predators, browsers, competitors, and parasites -- this is the Living Community of Isle Royale.

Thus, on Isle Royale, there are two "climax" forests: the spruce-fir forest which grows nearest the cooling influence of Lake Superior and the sugar maple-yellow birch forest which grows on the inland, south-facing, warm-dry ridge slopes. The spruce-fir forest arrived here during that period of time following the great glaciers when the area was

The Living Community of Isle Royale was written by Naturalists Johnsson and Linn. The subject matter is from the Interpretive Talks "The Web of Life" given by Robert Johnsson and "Living Communities" given by Robert Linn at Rock Harbor weekly during the 1958 season. The photographs were taken from kodachromes by the authors.



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