CONSERVATION
ARCHAEOLOGY
REPORT

LOCATIONAL ANALYSIS
OF
PRINCE EDWARD COUNTY

Ken Swayze
1976

Ontario Ministry
of Citizenship
and Culture
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INTRODUCTION

GOAL AND PURPOSE

The ultimate goal of locational analysis (or prehistoric geography) is to produce a predictive settlement model to isolate and identify probable settlement locations. This model could be used:

1. As a management tool to rate or gauge unsurveyed areas. If several developments are scheduled for different areas at the same time, the model can be used to assess each development site and predict the prehistoric settlement potential.

2. As an aid to research, the predictive model will lead to aerial syntheses and reconstruction of prehistoric lifeways.

Purpose of This Study:

The purpose of this study, however, is not to produce the model itself, but to develop the necessary methodology and illustrate by example how the model can be created.

LIMITATIONS

Due to time constraints, it has not been possible to collate all the available environmental and archaeological data. Limitations in this respect are:

1. The palynological record of Prince Edward and the surrounding area has not been completely reviewed, but will be necessary to validate the assumptions and the hypotheses in this study. "Inferring the past from the present" may prove adequate for a general assessment, but pollen cores are needed to substantiate and refine the results.
2. There is no firm chronological sequence of sites in the county; nor can the inventory be considered complete. Further survey and excavation will be needed to determine site seasonality, cultural lifeways, and demographic distribution.

3. Research is needed in botany and zoology; to determine accurately the characteristics and attributes of available food resources.
METHODOLOGY

RECONSTRUCTING THE PALEO-ENVIRONMENT

Relicts, Informers, and Survey Reports

This method was developed by Arthur B. Williams in Ohio in 1949. It consists of studying woodlots which contain trees from the original forest. This is usually determined by measuring, at breast height, the trunk circumferences of trees which appear over 175 years old. The "relicts" are plotted on distribution maps, and early records, like newspapers, road surveys, land surveys, photographs and maps are gleaned. It may still be possible to gain information from elderly citizens, who either saw the original forests fall, or can recall information told to them by their family.

This method clearly has its limitations and cannot be evenly applied across a region. Furthermore, even when successful it can only reconstruct the forest at the time of white settlement. Still, it is a source of information, and with other methods should produce the most reliable reconstruction.

Plant Fossils

Macro-fossils are twigs, seeds, and bark of earlier forests; they are found in the humus of present-day forests, and buried soils, or from archaeological sites. Unless they are carbonized, or "pickled" in a bog, macro-fossils will not persist for long and their value to relict studies is limited.

Micro-fossils, or pollens, however, can present a record of the past. The study of plant pollens, or palynology, is based on simple facts:

(a) The structural characteristics of pollen grains are constant for a genus.

(b) The average regional pollen rain contains a mixture of pollens representing forest composition.

(c) Pollen settling to the deeper water of a bog may be preserved by antiseptic, low-oxidation conditions.

(d) Stratification may develop over the years, providing a sequence of forest change and hence climatic change.
The pollen is collected by taking core samples from bogs, or varved lake bottoms, and is prepared in the laboratory for microscope viewing. For each strata of the core the palynologist identifies and counts from 200 to 1,000 grains. (There may be 50,000 to one million pollen grains in a gram of peat). The results are tabulated on a pollen diagram, which visually shows the incidence of pollen from various forest types through time. The strata are dated when possible by radio-carbon and radioisotope methods. By studying these diagrams the palynologist hopes to demonstrate changes in temperature and climate throughout the Quaternary.

There are some limitations to palynological studies; although most can be overcome through perseverance.

(a) A reconstruction and interpretation of pollen can take place only when there is a suitable continuous record; many areas may not have suitable varved lake bottoms or an abundance of bogs. If taken from a bog, the record can only relate to the birth of the bog, which will differ in every case. Some bogs or kettles were formed by melting blocks of ice trapped in a depression after the retreat of the ice sheet. Sometimes these blocks were covered with soil and did not melt for many centuries.

(b) Usually the forest immediately surrounding a bog (within a radius of 500 metres) is strongly represented in the sequence. Thus there might be over-representation if the surrounding habitat was suitable for only one forest type.

(c) It is usually impossible to distinguish between species in a genus unless size is involved. The problem of distinguishing between species of Quercus (oaks) is particularly difficult.

(d) Not all pollen grains are easily preserved. The condition of the pollen grains depends upon the bog characteristics and the speed with which they settle to the bog's deepest level. The pollen can also be damaged in the laboratory as it is being prepared for slides. Not all pollen preserves well, and although most tree species are good preservers, the pollen of the under-story plants is more fragile and is not well represented in the "regional rain".

Because of these limitations, it is necessary to take as many core samples as possible throughout a region, for only when many pollen diagrams from different localities show comparable trends can climatic change be demonstrated and dated.
At the present time it has not been possible to compile and assess the data for Prince Edward. There have been samples taken from Lake-on-the-Mountain, and evidently Terasmae of Brock University has done palynological work in Prince Edward (Jock McAndrews, personal communication) but the extent and nature of his work is unknown at present. More samples should be taken from as many sub-drainage units as possible, for the settlement-subsistence model depends upon reconstructing the environment specific to each locality.

For the present, the most feasible method of reconstruction is a combination of early records and the interpretation of soil maps.

Perhaps the single and most important guiding principle in interpreting and reconstructing pre-existing vegetation is the geological concept of uniformitarianism, or the assumption that the present is a key to the past. According to F.S. Baker (1950:180), a virgin forest consists of species best-suited to the site.

STAGES OF FOREST DEVELOPMENT

The stages of forest development, or vegetative succession, are best revealed through the palynological record which is as yet poorly understood in Prince Edward; however, the various stages known form many areas in eastern North America and Europe can be summarized, and apply to Prince Edward in general.

The earlier climatic hypothesis, known as "Blytt-Sernander" has five distinct stages: (from Cain 1939)

1. Pre-Boreal - a cool, humid period
2. Boreal - a warm, dry, continental climate
3. Atlantic - a warm, humid climatic optimum
4. Sub-Boreal - a drier, continental climate
5. Sub-Atlantic - a return to humidity

Later, a simplified version was proposed by Van Post: (from Cain 1939)

1. Increasing warmth - characterized by the appearance and first increase of heat-loving trees (coniferous decline).
2. Maximum warmth - the stage of culmination of these forest elements. This period spanned Archaic times.
Reconstructing Forest Cover From Soil Maps

This method was conceived by J.O. Veatch in 1928 and was tested and recorded by him in 1932.

Briefly, the steps according to Veatch (1932):

1. The distribution of vegetation in general is a function of climate.
2. Climate is also a causal factor in the character and distribution of soils.
3. Moisture and temperature are primary factors determining the nature of vegetation and these same factors cause local differences in soils.
4. Studies on the evolution of soils suggest that there is a simultaneous development of soils and vegetation.
5. Plants obtain a greater part of their nutrients from the soil, and a certain nutrient condition together with physical and chemical conditions is more favourable or unfavourable for one particular species or group of plants than for another.
6. Time has been sufficient for adjustments to take place between the soil and plant. The soil, especially the mature or normal soil of a pedological province, should be a perfect expression of the factors which determined the vegetation.

Veatch points out that it is necessary to study some forest relicts after the fashion employed by Williams (1949) to establish that a relationship between soil and vegetation exists. The soundness of this method depends upon the degree of consistency of particular forest types to conform to various soil types. This correlation appears to be closest where soils exist uniformly over broad areas; for when many small soil provinces are found in an area the forest will likely be mixed or species may be found in habitats they do not really prefer. Veatch sums up his argument by stating this method to be "as near an approximation to the truth as any other means".

Reconstructing Prince Edward's Paleo-Environment

After reviewing the methods of reconstructing, the author concludes that the best approach would be a combination of all of them; however, the palynological record is certainly the single most important, for it not only demonstrates vegetation (climatic) change, but can date it as well.
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2. Maximum warmth - the stage of culmination of these forest elements. This period spanned Archaic times.
3. **Decreasing warmth** - decrease of characteristic trees of warm period and the appearance or return of today's dominant forest. This period conforms to the beginning of the Woodland period.

More recently Bert Salwen (1975) has reviewed the palynological record for the Hudson River Basin and has essentially confirmed the Blytt-Sernander thesis, and has dated them to prehistoric culture periods. The post-glacial climatic stages then, with dates based on Salwen 1975, are:

1. **Pre-Boreal** - from before 8,000 to approximately 7,000 B.C. This would, of course, be the Paleo-Indian period and is characterized by spruce and pine associations, and cool and humid climate but increasing warmth.

2. **Boreal** - dating from approximately 7,000 B.C. to **circa** 4,000 B.C. This is a warmer, drier, more continental period, characterized by the first appearance and increase in sun-loving trees. This climatic period spans the late Paleo-Indian and early Archaic periods.

3. **Atlantic - Sub-Boreal** - This climatic period combines two Blytt-Sernander periods and spans the major portion of the Archaic period. It is dated roughly from 4,000 B.C. to 1,000 B.C. and is characterized by a warm-moist climatic optimum, succeeded by a drier, more continental climate and finally a succession of cooler, moister conditions. The forest of this period is characterized by the flourescence of oak and oak-hickory or oak-hemlock forests, depending upon local topography and climate.

4. **Sub-Atlantic** - commencing approximately 1,000 B.C., this climatic period marks the beginning of the Woodland period. Climatically, the period is characterized by a return to cooler, moister conditions and the flourescence of the pre-dominant forest cover of today (maple-beech). Later in this period, around 0 A.D., there was evidently an increase or onslaught of yet cooler and moister air, dating to around the end of the period of Hopewellian influence and marking the last half of the Middle Woodland period.

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The Persistence of Developmental Forests in Prince Edward

Through palynological studies, we can see that there was a general and progressive change or succession of forest type associations. Briefly, these developmental forest stages are:

- Spruce to Spruce-Pine to Pine-Oak to Oak or to Oak-Hickory or Oak-Chestnut or Oak-Hemlock and finally to Maple-Beech.
In describing the deciduous forests of eastern North America, E.L. Braun (1950) stated: "Because of the youth of the land surface developmental stages of plant successions occupy large areas sometimes obscuring the regional characters".

The characters of the topography too has been a factor determining the relative proportions of land covered with developmental and climax Communities. A number of species of oak, for instance, are able to occupy sites unsuitable for climax forest, such as sandy or gravelly morainal ridges too dry for maple or beech.

Relict oak-hickory communities are climax in characters and owe their development to a drier climate. They are able to establish long-enduring forests, if the main requirements (dryness) is provided which is less suited to beech-maple, and a dominance of white oak.

Prince Edward may well have supported just such a long-enduring developmental stage, probably dominated by white and red oak with associations of hickory and/or chestnut. This theory is supported by the remarkably shallow and dry soil of Prince Edward and the characteristics summer drought which has been rated the worst in Ontario. Furthermore, the bedrock in Prince Edward (Ordovician Limestone) is seldom more than three feet below the surface, thus increasing the effects of the drought and hindering the growth of trees with long taproots (maple among them).

The soils of Prince Edward are predominantly of the Brown Forest Group which were developed under deciduous forests. The Brown Forest Soils as a whole in the Eastern Region are unique to Prince Edward, as is its present climate and precipitation. Therefore, keeping in mind the maxim that the present is a key to the past and Veatch's (1932) assumption that the soil is a perfect expression of the vegetative and climatic factors that formed it, the author propores that a developmental forest dominated by oak and hickory or chestnut, established a long-enduring community throughout most of Prince Edward's better drained soils. This community was probably established during the Archaic (or Atlantic-Sub-Boreal) period and persisted until the time of contact, although it probably began to give way to the dominant shade-tolerant species in the Atlantic period sometime after the birth of Christ.
It may be argued that this is a premature hypothesis because the available locality-specific palynological record has not yet been studied and, of course, only this approach and further palynological testing, can prove or disprove the theory. It is certain, however, that the shallow droughty soils of Prince Edward would have been conducive to a higher incidence of developmental species, even if it can be demonstrated that there wasn't a dominant climax-like oak community in existence.
GAMES THEORY: A METHOD OF MEASURING FOOD RESOURCE POTENTIAL

In order to determine a predictive settlement-subsistence model, it is necessary to identify and classify all resources known or presumed to be available in Prince Edward during the Archaic and Woodland periods. Specifically, one must determine: which resources were being used; where they were being used; where they were or are located; how much of each resource there was; and how much of it was being used.

One of the main principles is to assume that the goals inspiring the hunter-gatherers of Prince Edward can be identified and formulated into a system. These goals can be determined by the archaeological record, historical records and ethnographic accounts of comparable people of today or the recorded past. This sort of study can, in many respects, be viewed as an "economic prehistorical geography" as it deals with the distribution of people and resources across a specific prehistoric landscape.

In order to answer these questions, one must remember the maxim, mentioned above, that the present is a key to the past and consider what is known today about the guiding principles and goals of modern and historical hunters and gatherers.

The major problem then is to define food resource priority, determine its habitat and devise a resource-use schedule. Then, by studying the site distribution, as it is known now, it should be possible to propose demographic models. Of course, only future survey, excavation, and analysis can test this model(s), refine it or construct another.

Man is (or was) rational in response to his food resources. This has been attested by many anthropologists and geographers over the years. Man is aware that his choices and decisions about food procurement involve a degree of uncertainty and that the risk involved in pursuing any one course of action is variable. The results of a "risky" operation, however, could be so advantageous as to outweigh the risk. Consequently, the resource-use schedule cognized by the hunter-gatherers is of the utmost importance.

Recently, M.A. Jochim (1976) collated the work of anthropologists studying hunter-gatherers around the world and presented a series of principles and assumptions about their common economic behaviour.

According to Jochim, economic behaviour is governed by a common criterion, known as the "Simon Satisfier": hunter-gatherers do not seek to maximize all their available resources but only to satisfy a predetermined aspiration level. Indeed, they practice the "least cost theory" for there is a distinct aspiration to live well with adequate leisure time. Therefore, considerations of distance and the limitation of effort underlie all economic behaviour.
To review, the assumptions made about hunter-gatherer decision behaviour can be summarized below:

1. Economic behaviour is the result of choice in seeking a solution to a problem.
2. Choices are always deliberate and not opportunistic.
3. Deliberation is rational.
4. The results are partially uncertain.
5. Behaviour seeks to satisfy aspirations not to maximize resource exploitation.
6. Choices are often, or usually, mixed strategy.
7. The desire to limit effort underlies all economic decisions.

The Resource-Use Schedule

Although the problems faced by Prince Edward's prehistoric hunter-gatherers can be identified and seasonally schedulized, it is important to remember that men and animals are not distributed across the landscape in a simple correspondence to food resources, for the desire to aggregate results in a non-homogeneous distribution in respect to resources.

There are two basic goals to which all hunter-gatherers can be said to apply themselves: (also adapted from Jochim 1976)

1. THE SECURITY GOAL - the desire to attain a secure level of food and manufacturing needs is a primary motivation. A safe and secure level, however, is usually not sufficient to allow regular and prolonged periods of human aggregation. The Security Goal is a biological fact and is not culturally oriented.

2. AGGREGATION DESIRE GOAL - is the desire to maintain energy expenditure with a predefined range; determined by the necessity of regular social functions among populations of inter-related families.
The Principles of Economic Behaviour

1. The desire to live well with adequate leisure time is a dominant motivation.

2. When two resources are available simultaneously, the hunter-gatherers will plan on emphasizing the most reliable and easily gathered of the two, especially if it is also considered more nutritious or tasty by them (i.e. hickories would be taken over acorns if possible).

3. A resource will be utilized when it is most efficient, which usually is when it is most available and most easily gathered, even if available all year. (For example, deer are taken in the fall when they are congregating for nuts and rut; they are also fattest at this time).

4. The consideration of distance is clearly an influence on all economic decisions.

5. Hunter-gatherers will plan on exploiting two resources simultaneously whenever possible, although the most efficient or nutritious of the two will be emphasized, unless considered equal, (i.e. similar types of *Arum*, or wild rice and hickories).

6. Hunting is considered a high-risk, low-return activity, except at times of animal aggregation, and can only satisfy the Security Goal with difficulty. Hunting small game can, however, support small families (i.e. Shoshone or Diggers) but will never allow large groups. Large game, however, can allow the aggregation goal to be achieved. The lifeways of the Mistassini Cree, as described by Rogers, is a good example.

Criteria for Food Resource Preference

1. Hunger-allaying properties of a plant or meat are clearly a criterion. For example, greens do not satisfy physical requirements in the same fashion as meat, nor does the meat of a rabbit satisfy like meat of a beaver.

2. The ease of procurement is also an important criterion. Some resources are more easily procured than others, and most resources are more easily procured at certain times of the year. Rice and nuts, for instance, are more easily procured than deer, but all three are most easily procured at specific times during the autumn.
3. The nutritional or taste qualities of a food resource are another criterion. The quantity and quality of fat or oil in various foods plays a role in taste and nutritive preferences.

4. The storable qualities of resources are important, especially in the northern climes where, even during the (Archaic) climatic optimum, the winter was a major factor. Consequently, those nuts, roots and meats lending themselves best to overwinter storage would be preferred.

5. The effort of preparing the resource, either to make it storable or to make it edible must certainly have been an influence. Red oak acorns, for instance, require elaborate methods of roasting, leaching and grinding, while hickories and chestnuts require the least.

Food Resource Attributes

There are four main attributes for every food resource: weight \(w\), density \(d\), aggregation size \(a\), and mobility \(m\).

Weight - refers to the average weight of an animal or the crop of a single plant, and is expressed in kilograms. This value can vary throughout the year.

Density - refers to the number of animals or individual plants estimated to be in any square kilometre of the study area throughout the year.

Aggregation Size - refers to the number of animals or plants in the same locality at different times throughout the year and is expressed as the number per square kilometre per month.

Mobility - refers to the average distance per unit time that an animal is capable of travelling. It is expressed by an arbitrary number: i.e. Deer 1.15 and Rabbits 0.05. Plants, of course, are virtually stationary and are rated as 0.001. In arriving at mobility values, it is also necessary to keep in mind the regularity of behaviour of certain species, and to consider their "localizability" as a modifying factor. Deer and fish, for example, can be driven into more localized groups (in corrals or weirs), thus negating their high mobility values.

Secondary Attributes

There are secondary resource attributes whose arbitrary value, either singly or in combinations, may be added to the value derived from the primary attributes. A high score of secondary attributes may then
make an "expensive", "risky" resource more valuable so that it may become a more efficient resource. These secondary attributes are:

1. **Fat or Oil Content** - plants and animals with these qualities are considered nutritious and essential by all hunter-gatherers.

2. **Non-Food Yields** - these include bone, teeth, fur, hide, antlers, shell, sinew, etc. Sometimes the non-food yields become so valuable as to constitute the major reason for procurement. For example, the non-food value of muskrats eventually became almost the sole purpose for trapping them.

3. **Prestige Value** - is important in many cases, especially with large game. Bear and deer for instance clearly give prestige to the hunter and are thus a great incentive to travel seemingly inordinate distances to hunt them.

### Measuring Food Resources

Each resource can be measured according to the degree that it satisfies each goal for each month of the year. The two resultant values can then be averaged to produce a single measurement of performance.

The performance of a resource can be measured according to its ability to satisfy the **Security Goal** by multiplying weight times density, divided by mobility (wd/m). The greater the weight and the density of a resource and the less the mobility will produce the least risk (expressed as a higher score).

The performance of resources to satisfy the **Aggregation Goal** is determined by multiplying weight by aggregation size, divided by mobility (wa/m). Thus the greater the weight and aggregation size, and the smaller the mobility, the less risk is involved and the better the resource will score.

After the basic score has been computed for each resource, each month according to each goal, it can be improved by adding the secondary attribute values, such as antler or oil.

The resource-use percentage of each resource for each month can be deduced for each goal by summing all the resource scores for each goal and dividing the result into the individual resource scores times one hundred:

\[
\text{RESOURCE-SCORE} \times \frac{100}{\text{SUM OF SCORES}} = \text{RESOURCE-USE PERCENTAGE}
\]

In the final step, the two resource-use percentages for every resource, every month, are simply averaged to produce a total resource-use percentage.
Scoring Sub-Drainage Units By Games Theory

When the total resource-use percentages for each resource have been computed for every month of the year, then each of the sixteen sub-drainage units can be "scored" according to its monthly ability to support each resource. When the monthly values are totalled, then the sub-drainage units with the highest scores should be the focii of seasonal activity. This does not necessarily mean that the main habitation will be there, but there should be procuring and/or processing stations. However, unless the resource possesses a high secondary score of non-food and prestige value, the main camp will not be any great distance away. (Least Cost Theory).

The method of actually scoring the sub-drainage units are arbitrary and varying. Deer, for instance, can be scored from the ungulate potential maps prepared by the Federal Government; beaver can be rated according to the number of miles gradated streams and swamp per sub-drainage unit, and plant-resources, such as nuts and roots, will be rated according to what is known about the plants' preferred habitat (especially soil and light preferences) and the proportion of such habitats in the unit. The number of miles of stream and the number of square miles of marsh, swamp and bottomland will be of importance for scoring a great many resources. (The reader should note that this study is theoretical and the natural sub-drainage unit scores have not been determined).

It has been states by Peter R. Gould (a geographer who has used games theory) "...that extreme accuracy of data, while always desirable, is not essential in order to use games theory as a tool since it can be shown that pay-off matrices, subjected to a fairly high degree of random shock by injecting error terms, can still give useful approximations and insights upon solutions." Thus in the near future it should be possible to construct a tentative model with the estimated resource attribute scores presently available. Certainly the continuance of this study would refine the data and produce a much more stable model.
THE FOOD RESOURCES OF PRINCE EDWARD

THE FOOD PRODUCING TREES OF PRINCE EDWARD

The species described are those considered to be important food resources found in Prince Edward during the Atlantic - Sub - Boreal climatic period (Late Archaic times), and the subsequent Sub - Atlantic (Early to Middle Woodland) period.

Without a series of good palynological records from Prince Edward it is impossible to determine if, indeed, they were present, and any attempt at postulating a ratio of one species to another would be tentative at this stage. There have been palynological studies done in Prince Edward, (J. Terasmae) but the record is not comprehensive or geographically specific enough to be of maximum use in scoring sub - drainage units.

It must be realized that these species were not the only nor necessarily the dominant trees at that time, for conifers would have been common, as well as birch, alder, willow, elm, maple, ironwood and cherry. This must be kept in mind as one tries to determine where resources (food trees) were to be found and in what number.

Before such determinations can proceed very far it will be necessary to study the existing palynological record for Prince Edward, to determine the general character of the vegetation and to test the hypothesis that Prince Edward supported a long - enduring developmental stage of hickories and chestnuts. (This theory is discussed in section 2:02.1).

The palynological record, however, does not always distinguish between species of a genus. This means that chestnut - oaks and red oaks would be recorded alike as Quercus, and pignut, shagbark and shell - bark hickories would be lumped as Carya. This is unfortunate, because species usually have varied habitats and food resource attributes. Unless this problem of identifying between species can be resolved (evidently pollen size can identify some), it will be necessary to hypothesise the presence and proportionate ratio of all species, regardless of food value. The present palynological record should be able to provide a rough proportion of genii adequate for games theory.
Preferred Habitat

At present it is possible to discuss the prevalence of important food species in general terms by describing the overall potential of each sub-drainage unit to support these species (see Sub-Drainage Units), assuming that in a natural forest each species will grow in its most preferred habitat (F.S. Baker 1950: 182). Of course, any natural forest will have its open glades, with scattered trees, its thickets of saplings and areas of wide spaced veterans.

For instance, the well-drained edges of the marshes and streams of Prince Edward, and the southern and eastern slopes (receiving most direct prolonged sunlight), would support most of the trees which rate sun essential (intolerant species): walnuts, oaks, plums and hawthorns. Hickories too are somewhat intolerant, and some, especially pignut, prefer highlands where competition for sunlight is not as great. Other species like shellbark hickory and bur oak are almost totally restricted to bottomland and alluvial soils.

Species like walnuts and white oak have large taproots and would be restricted in some Prince Edward soils and probably impossible on others. Farmington loam, for instance, could not support these species because it is seldom over a foot in depth. Red oak, chestnut oak and chincapin oak, on the other hand, would probably do very well on the thin soils of limestone parent material, and chestnut, which does not like too much limestone, may have been hindered.

Water-loving species, like some maples and elms, cedars and willows, would be almost solely confined to the food bearing trees are habitants of well-drained soil. Beech and maple however, (the dominants of the Sub-Atlantic), may have been restricted by the drier weather of the earlier climatic optimum, and may have been retarded in development in Prince Edward due to the dry soil and droughty climate (see page Certainly they would have become increasingly more prevalent, especially on the north and eastward-facing slopes where such shade-tolerant species could develop foot-holds.
Density

There are two aspects of density which must be considered in hypothesizing the amount of food: (1) the overall distribution or percentage of total forest composition, and (2) the aggregation size as determined by thicket growth or isolated bottomland trees.

Those food species with the highest overall distribution would most likely be oaks and hickories, followed by chestnuts and walnuts. Of these genii, bur oaks, shellbark hickory and walnut are known as bottomland dwellers, where they may attain great heights. Because the borders of streams, swamps and lakes are often frequented by man, clearings and cutover areas would have begun to develop, thus isolating veterans and giving them more growing space and sunlight. According to F.S. Baker (1950), isolated trees on a favourable habitat are notoriously heavy seeders.

Hickories are a species of intermediate shade tolerance (prefers sun but will come up in shade and reproduce under its own cover), and have more stems per acre than any other food species, (Cain S A 1932) and might present a fairly high aggregation size within easy access of streams or bays.

Some species, like chinquapin chestnuts and chestnut-oaks, would have a very high aggregation size, making them an efficient resource to gather; however, their overall distribution and accessibility are uncertain.

Some food-producing species with the lowest overall distribution (walnuts, plums, hawthorns and probably some oak species) still may have a high aggregation size, due to their short stature and habit of growing in thickets, groves or groups. Often this density is localized along watercourse borders and low accessible hills.

Weight Or Crop Measure

Statistics regarding weight or crop measure are not complete. It would appear, however, that chestnut-oak and chestnut have the biggest nuts (75 and 130 to the pound respectively - hulled), followed by white oak (150 to the pound) and red oak. Walnuts, while large in the shell, are quite small if measured by shelled nuts to the pound;
(statistics are not available, but personal experiment indicates that a bushel of walnuts and a bushel of filberts both weigh about 50 - 55 pounds, and if there are 490 filberts to the pound the same should be true for walnuts). There are no statistics for hickory concerning number per pound, but as the length approximates that of chestnut (4" long), the value for hickories must approximate chestnut (about 130 to the pound). The smallest nuts appear to be beech at 1600 shelled nuts per pound (Harlowe and Harren 58), and probably pignut hickory (no statistics).

The most reliable seeders are pignut hickories which seed annually with very little variation. Hickories and chestnuts, as a rule, are the most reliable seeders they give some seed annually and a "bumper" crop every three to five years.

Beech would appear to be the most unreliable crop as it fails frequently, and a good crop can only be expected every three to five years. Black walnut and white oak are of intermediate reliability, as they fail frequently but give a bountiful crop every two to three years. Statistics of this nature for the other species are not available, although inferences from other species of the genus may be implied. The chinquapin chestnut and the red oaks are biennial seeders but because half the trees seed annually they are a reliable resource. It should be noted that a good seed year for one species is not necessarily a good one for another species, and no single year is excellent or poor for all species. Nut - weevils, squirrels, lack of precipitation and possibly even windless pollination periods, all have great effect on nut crops. Among some species the variation can be great, with some trees seeding prolifically in some areas and not in others, or seeding heavily across a region. In some years the nut crops, in general, may be good across wide regions, and in other years the crop may fail regionally but do well locally.

Food Quality

Once again, there is a lack of consistent statistics. The nuts highest in oil, however, are walnut (65%) and butternut (64%), followed closely by shagbark hickory with over 47%. Beechnut is 30% oil, and red oak acorns have been estimated at 11% to 23% oil by various authors. Chestnuts are quite low in oil, comparatively, at 7%. Oak acorns have the lowest oil content (3.5%) yet they were still esteemed as an oil producer by the Indians of eastern North America (Fernald and Kinsey 1943). Perhaps this is because oaks are highly aggregated across large areas and are the most reliable crop.
Those nuts highest in protein are once again black walnuts, and butternut which are 27% and 29% respectively; beechnuts are next at 15% protein, then hickory (shagbark) at 12% and chestnut at 11%. Both white and red oaks are the lowest, with between 3% and 4% each. (Note: the percentage figures given are for available or digestible protein.)

The nuts highest in carbohydrates are white and red oaks at 43% and 25% respectively, and then probably chestnut, which is high in carbohydrates (no statistics available). Beechnut is also quite high at 26%. Black walnut is listed at 16% carbohydrate, and butternut is given as 3.5% starch, although its total carbohydrate level is probably similar to black walnut. Hickories appear to be lowest, with 8% carbohydrate.

The palatability of nuts appears to be in direct proportion to the amount of tannin in them (Martin et al 1961: 308). In this respect, the walnuts are lowest (therefore "sweetest") at .25% (given for black walnut; butternut is presumably similar), closely followed by shagbark hickory at .47%. There are no figures for chestnut, but its tannin content is certainly low as the nut is always referred to as "sweet". The highest tannin level is for oaks: 5.5% for the white oak and 9.5% for the red oak. This level of tannin makes all acorns bitter to the taste and usually unfit for human consumption until leaching and boiling have rendered them palatable.

In conclusion, it would appear that the most desirable nuts in terms of taste and content would be walnuts, followed by hickory, beech and chestnut. Acorns should be the last choice because of their high tannin and relatively low oil and protein content.

Hunter - Gatherer Priorities

This ordering of priorities according to taste and composition is, of course, not the priority recognized by Archaic and Woodland peoples for, according to what early accounts tell us, acorns (both red and white) were exceedingly important. Hickory and/or chestnut would appear to be next in popularity, followed by walnuts and beech. Significantly, the actual popularity of these nuts is in direct relation to the overall distribution and reliability of the species, for oaks were, and often still are, a dominant forest species widely distributed across large regions. Also, even during fail years, acorns would be available because, as we have seen above, even when a species fails across a board region, there will still be
good crops in some localities. Furthermore, red oaks are annually reliable seeders (like pignut hickory), for although the fruit takes two years to mature, the red oak population is not in unison and the overall crop would be annual and usually abundant (Martin et al: 308). This is a prime example of the Simon Satisfier criteria (see Games Theory), used to satisfy the goal of providing a safe, secure level of food. Aside from their reliability, red acorns have the advantage of a relatively high oil content; it occurs to the author that this might account for the seemingly high use of this resource even when white oaks may have been abundant.

Next, in terms of hunter-gatherer preference, would be hickory which is highly nutritious, high in oil and easily prepared. Hickories, especially pignut, are reliable and widely distributed (with a fairly high aggregation size), across board regions.

Walnuts are certainly the sweetest nut, but their overall distribution and local aggregation size are both quite low (especially butternut), and they have thick shells and relatively small meats. These trees both enjoy bottomland and streamside habitats, however, and were therefore quite likely to be no great distance from recurrently occupied seasonal camps. Furthermore, for these reasons they may often have become "isolated veterans" capable of providing a prolific and reliables crop (but only from a few trees locally).

There are at present no available statistics about wild plums, but they are obviously high in fructose, vitamin C and carbohydrates. Like walnuts their overall distribution is low but, because they are thicket grows, they are capable of achieving a high local aggregation size. In addition being sun-lovers and fond of streamside habitats, they could conceivably have been very accessible to settlements. It is likely that the importance of this fruit increased with the increase of maize agriculture, because plums would favour the edge of fields for growth. Plum pits are common on Iroquoian sites and they were important foods to the Iroquois (Waugh 1916).

There are very few statistics about hawthorns, but their distribution and aggregation size would, in general, resemble plums. Hawthorn fruit, however, even at its best,
is dry, thin - fleshed and gratinous. They do, however, have the advantage of preserving well and some species stay on the tree until winter. This may have made them a relatively valuable "survival" food. Hawthorns are high in vitamin C thus providing essential winter - time nutrition.

**Method Of Utilization**

It is interesting to note that the two most reliable and widespread nut - bearing families, oak and hickory, have very different physical properties, and the nuts were probably prepared and consumed in different fashions as well. The hickory, with its relatively thick, hard shell, high oil and protein content and sweet flavour, lends itself well to the "crush, boil and separate" method, with no leaching (of tannin) necessary.

This method is described by J.E. Rogers (1905), who cites early accounts of this method. Evidently the oil was then skimmed off and used as a body ointment and food, and the strained meat was dried for later use in soup or bread. The juice was consumed immediately, probably with venison, turkey, or squirrel (which would themselves be aggregating to consume nuts).

Acorns, on the other hand, are bitter and require leaching and repeated boiling, in addition to hulling and grinding. Roasting, too, may have been part of the acorn preparation process. Although Rogers (1905) cites Mark Catesby (circa 1750) as stating that acorns were used for soup, it would seem from other accounts (Fernald and Kinsey 1943), that acorns were usually ground to flour and used in breadstuff. Indeed, because of the high carbohydrate content of acorns and chestnuts, the author suggests that their main use, aside from oil, was a breadstuff and more rarely for soup. The flesh of hickories could probably be used for either soup or bread, but because of their low carbohydrate content they probably lend themselves better to thickening and enriching soup.

Hunter - gatherer preference, in satisfying the security goal, would probably be for oaks and hickories. Among the oak family, white oak was probably preferred, because of its sweetness and because it would require less work to prepare. However, the white oak would fail frequently, and hunter - gatherers would have to take red. Red oak may, however, have been preferred on
occasion, specifically for its oil. Of the hickory family, the shellbark would certainly have been a favourite if readily accessible, for it has a larger, "sweeter" nut with a thinner shell, and could be produced fairly reliably by "isolated veterans" close to camp. Shellbarks, however, would have a low overall distribution and a low local aggregation size. The shagbark hickory then, with its high overall distribution and relatively high aggregation size (one to two bushels of nuts in the shell per tree annually—Martin et al. 1961), was probably the main candidate in this category.

Season of Availability

Once again, the information available is not consistent to species or unit of measure. All nuts are available in the fall though, usually in October after the first heavy frosts (unless the wind or squirrels knock them down prematurely). Beechnuts evidently all fall entirely on the night of the first "killing" frost. Chestnut is one of the latest species to fall, being available into November, and pignut hickory is the earliest, available as early as mid-September.

The early season of the pignut hickory presents an interesting problem in games theory. They are the most dependable hickory nut, and should be attractive for that reason. However, pignuts may have been so "expensive" in labour that this advantage was negated. (Pignuts are small, thick shelled, quite bitter, require leaching and boiling, quite inaccessible, and are upland species of ridges and hills). How much simpler life would have been for the resource users if pignuts fruited late. They would have been ideal for satisfying the "security" goal. (Perhaps a scout sent out in mid-September could estimate the potential nut-crop of preferred, less "expensive" species. Thus, if a shagbark or white oak crop failure seemed imminent, there would still be time to take advantage of the "expensive" pignuts.)

The plums and hawthorns have the advantage of being available for a large period of time; from August to October for the plums, and September to December for the hawthorn family.
THE FOOD PRODUCING WATER PLANTS OF PRINCE EDWARD

The following species have been considered by the author in terms of food - producing "efficiency", as recognized by Archaic and Woodland hunter - gatherers: (Efficiency is defined as the ratio between useful work (product) and the energy expended.)

Wild Rice  \( \text{Zizania Aquatica} \)
Cat - tail  \( \text{Typha Latifolia} \)
Bulrush  \( \text{Scirpus Validus, S. Actus} \)
Yellow Water Lily  \( \text{Nuphar Advena} \)
White Water Lily  \( \text{Nymphaea Tuberosa} \)
Chuffa Nutgrass  \( \text{Cyperus Esculantes} \)
Bur - reed  \( \text{Sparganium} \)
Arrowhead  \( \text{Sagittaria Latifolia} \)
Pond Weeds  \( \text{Potamogetan Pectinatus} \)
Pickerel Weed  \( \text{Pontederia Cordata} \)
Blue Flag  \( \text{Acerus Pectinatus} \)

These species are discussed according to habitat, density, weight or crop measure, food quality, method of preparation, storage, and season of availability.

These qualities will be reviewed and summarized, and the resources considered the most efficient will be delineated.

Habitat

Almost all of these aquatic herbs are to be found in very similar habitats, often growing side by side. The main habitat description, is: the margins and shallow water of muddy or silty - bottomed ponds, bays, streams and swamps. Chuffa (and other sedges) is the major exception here, for it can be found in a variety of moist soils, including sandy loam - it is, however, most common at the margin of watershores.

The habitat within the bodies of shallow mud - bottomed waters is another matter, and a much more difficult one to isolate for these plants, today, have little economic
value and scientific studies of their habits are even more
difficult to find than ones for trees. Nevertheless some
crucial preferences are apparent. Wild Rice (Zizania
Aquatica) for instance, must have a silty bottom and slowly
circulating water to survive; consequently it is rarely
found remote from open water and wave action or from the
delta of slowly flowing rivers and streams.

Perhaps the most valuable account of aquatic plant
habitats within these bodies of water are the water
vegetation maps drawn by the Conservation Authorities
Branch. These maps detail the distribution and aggrega-
tion of nine edible species for East Lake, West Lake,
Pleasant Bay, Huyck Bay and Conecon Marsh. A detailed
discussion of these distributions in respect to prehistoric
site locations is presented in the section on Site Distri-
bution.

The single most important problem with the distribution
and aggregation of aquatic plants as they appear today,
is the reliability of the present pattern to interpret
the pattern of prehistoric times, especially the Archaic
period of presumed hypothermic conditions. In this re-
spect the author knows of no scientific methods which
may be used, for the palynological record of aquatic plants
is either not present in the pollen sequence, or (quite
likely) it is present but has not been considered by
palynologists.

In the author's opinion, the present is a key to
the past and present - day distributions may be considered
indicative of the past. This is especially so in the
Marshy shore waters, for they were probably in Archaic
and Woodland times in much the same state as today.
Some inland swamps were clearly of a different character
and were evolving at different rates. Although the author
does not pretend to be an authority on aquatic plant suc-
cession, he does consider that communities of today can
be indicative of those of the past, even though some major
differences in distribution and especially aggregation
size exists. The role of climate in influencing vegetative
succession is, of course, fundamental to the study of
palynology. A higher mean temperature of a few degrees,
or a lower mean annual precipitation of a few inches, has
great repercussions on terrestrial herbaceous and woody
plants, but it is not certain how these climatic conditions
effect aquatic plants. Presumably the amount of precipi-
tation would have little effect, unless the body of water
reduced greatly or dried up. The effect of higher tempera-
tures upon aquatic plants is more difficult to assess,
but it is certain to affect all plants. However the author maintains that the overall aquatic population would not be significantly different than today. Certainly, as water levels fluctuated the plant communities would advance and recede too, but within the same area of shoreline. Perhaps the most convincing argument favouring this interpretation is the archaeological site distribution itself, which conforms very well with the demography of today's "efficient" plant communities. (See especially East Lake in "Site Distribution".)

As stated above, there are major exceptions to this rule, as the density (meaning both distribution and aggregation) of some species have clearly changed. Cat-tail (Typha Latifolia) for instance, has increased fantastically in the last 100 years as the water table dropped, and many areas began to silt in as a result of erosion due to agriculture. For example, an 1898 map of Prince Edward County (published by the Canadian Map Publishing Co., Hamilton), shows a great deal of open water in Muscote Bay to the south of Big Island and around Huff's Island. All later maps, however, show increasing areas of "marsh symbols", indicating that Cat-tails were increasing steadily. Today these plants are so dense and extensive that nesting wild-fowl have dropped to less than a quarter of their old numbers.

The dominance of Cat-tails is becoming apparent and it affects all other plant and animal communities too, most notably: Wild Rice (Zizania Aquatica) and Arrowhead (Sagittaria Latifolia). Bulrush (Scirpus), and Water Lilies (Nuphan Advena and Nymphaea Tuberoae, N. oederata) are being effected as well, but they may be more adaptable. (The Water Lilies being able to advance ahead of the silt and Cat-tails; the Bulrush is capable of advancing ahead of Cat-tails in deeper water, and probably of retreating behind on to suitable gleysolic musk soils.

At the present, it appears that Cat-tail dominance in the west shore waters is not so severe that the traditional community habitats are erased. This is especially true in East Lake and the west half of West Lake. Pleasant Bay, Huyck Bay and Conoseon Marsh, however, are greatly effected as is the east half of West Lake. This is because all these bays drain broad areas of Prince Edward's prime agricultural land and are thus inundated with quantities of silt and synthetic fertilizer, whereas East Lake and part of West Lake are not so effected due to their open expanse (allowing circulation), and sandier bottoms. East Lake does not drain a large area, nor is that area as heavily cultivated.
It is still possible to reconstruct the aquatic demography of the affected areas to some extent by using the Conservation Authority maps and in some cases, by questioning older inhabitatants (especially fishermen) about the location of previous Wild Rice communities, etc.

Density

There are two aspects to plant density which must be considered:

1. The overall distribution of individual species. In other words, how many communities of Yellow Water Lilies or Arrowheads are there in one body of water, and how many communities are there in a number of bodies of water across a region?

2. The aggregation size of each species is important in order to measure resource efficiency. In lieu of more specific statistics, aggregation size will be expressed as: scarce, common, very common and abundant (or dominant).

Density, then, is the combination of these two aspects of plant geography. Density can be roughly measured for eight edible plant species in the west shore waters by using the detailed vegetation maps prepared by the Conservation Authorities.

The overall distribution can be determined by counting the number of communities of each species for each body of water and averaging their sum. Thus the species can be scored as follows: Bulrush (Scirpus) 17.5, Cat-tail (Typha) 9.7, Pond Weeds (two species of Potamogeton) 11.6, Yellow Water Lilies (Nuphar) 6.6, White Water Lily (Nymphaea) 5.5, Wild Rice (Zizania) 4.7, Arrowhead (Sagittaria) 3, Pickeral Weed (Pontederia) 2.5, and Bur-reed (Sparganium) 1.6. (Note: Cat-tail may be greater than Bulrush for both of these species are dominant for vast areas along most shores, and are harder to score than those species with a high overall distribution and clearly defined community groupings).

Wild Rice scores much lower today in terms of overall distribution, due to the lack of circulation and Cat-tail dominance. This is apparent in the testimonies of some older residents (i.e. Rev. B.P. Squire) and the historical accounts of the great Wild Rice harvests of yesteryear.
Arrowhead, too, would probably have been higher in the past, so that the true order in some areas may have been more like: Bulrush, Cat-tail, Wild Rice, Arrowhead, Water Lilies, Bur-reed and Pickerel Weed.

Aggregation size may be extrapolated from these maps by averaging the score given by Conservation Authority (1 sparse, 2 common, 3 very common, 4 abundant) for each species for each body of water and averaging the sum. Thus:

1. Cat-tail  Typha  3.6
2. Bur-reed  Sparganium  2.6
3. Bulrush  Scirpus  2.5
4. Pond Weeds  Potamogetan  2.3
5. Pickerel Weed  Pontederia  2.3
6. White Water Lily  Nymphaea  2.1
7. Wild Rice  Zizania  2.0
8. Yellow Water Lily  Nuphar  2.0
9. Arrowhead  Sagittaria  1.2

Once again, Wild Rice and Arrowhead should score much higher, not only because of their much reduced overall distribution but also because there is more to aggregation size than abundance of plants, for Wild Rice is a heavy seeder and each Arrowhead plant has a number of tubers. Consequently the true order of aggregation size approximates the proposed order of overall distribution.

Weight or Crop Measure

There are no statistics available for any of the edible aquatic species in this respect, so it is only possible to discuss them in general terms.

Among the seed producing plants, Wild Rice was undoubtedly the highest producer and according to historical sources it was indeed a dietary staple. The name Menomin, even supposedly means "Wild Rice Men" or something to that effect. Many historical accounts describe "canoe-loads" of grain collected in a day.

The seeds of Water Lilies are potentially an important food item, as they are large, easily gathered and farinaceous. However, there are few accounts of their use in the eastern woodlands, perhaps because the more efficient Wild Rice is available about the same time.
Among the plants with edible roots, the tuberous, farinaceous Arrowhead was undoubtedly popular and efficient when found in abundance. In general all tuberous plants should be advantages, although their preference for deeper waters may have made the late fall harvesting rather arduous. Quite likely the tubers of Pond Weeds, White Water Lilies, Arrowheads and Bur-reed were gathered indiscriminately in areas where all or combinations of these plants co-exist together.

Cat-tails and Bulrush, however, do have good root-stock yields because of their high distribution and aggregation size. Furthermore, they are usually in shallower water and are more accessible.

It is interesting and significant to note that all plants with edible root-stock or tubers are similarly favoured by muskrats (especially Bulrush and Cat-tail), and there are several accounts of muskrat houses being robbed of their winter stores. All root-stock and tubers are at their best late in the fall, so it is quite likely that as soon as the ice in marshy areas would bear the weight of a man, muskrat hunting and root gathering would coincide.

There are no statistics available for Chuffa, although sedges are common and abundant along the west shore, they were not mapped as consistently as other purely water-oriented species. Chuffa has many seeming advantages. A high density, they are tuberous, farinaceous, more accessible to man, and may possibly be gathered somewhat earlier in the year.

Some species, notably Cat-tail and Yellow Water Lily, have high crop yields because different parts of the plant are available at different times of the year.

Food Quality

All the edible root-stocks and tubers are high in carbohydrates, especially starch, and most are farinaceous and thus used for bread. Important among the farinaceous roots are: Cat-tail, Bulrush and Arrowhead. Their flour is often described as palatable, wholesome and of good texture.
The seeds are all valuable for flour as well, especially Yellow Water Lily seeds which are supposed to have good texture and palatability. Wild Rice apparently was more popular in soup and stew. Both Wild Rice and Water Lilies have high protein content and are very nourishing.

Season of Availability

To generalize, it can be said that greens and shoots are usually gathered in the spring and early summer, although some roots would be relished first thing in the spring. Seeds would be the dominant summertime-early fall crop. Roots and tubers are best gathered as late in the fall as possible.

Hunter-Gatherer Priority

As with the nut-bearing trees, it appears that the most efficient and reliable resources are those with the highest density, especially aggregation size. These species are: Wild Rice, Bulrush, Cat-tails and Arrowheads.

Wild Rice is probably the single most important species and its presence in any quantity today could be indicative of a nearby site. There is some risk involved in gathering Wild Rice, however, for the seed can drop entirely in one day; thus it is possible to miss the rice harvest due to bad planning or inclement weather. Therefore there may be some strategic emphasis on less efficient resources, such as Water Lilies or Bur-reeds.

Among the root crops, all potentially available at the same time, Cat-tail and Bulrush are probably the most efficient because of their high density, reliability, farinaceous qualities and relatively easy manner of gathering. Tubers, although usually larger, often farinaceous and tasty, are more difficult to gather and are probably secondary in importance, except in areas of high aggregation or unless other more desirable resources fail.
THE EDIBLE TERRESTRIAL PLANTS OF PRINCE EDWARD

A detailed account of the species listed below is presented in Appendix III. The following terrestrial plants are considered to have been important to prehistoric hunter-gatherers of Prince Edward:

Jerusalem Artichoke  
Evening Primrose  
Dock  
Milkweed  
Goosefoot  
Pigweed  
Chokecherry  
Sandcherry  
Elderberry  
Serviceberry  
Blackberry  
Grape  
Strawberry

Habitat

Although there is an extremely wide range of habitat for these plants (ranging from moist or swampy ground or rich soils to dry, gravelly ground) there are some common characteristics. For instance, almost all of these species are sun-loving and delight in either pioneering newly disturbed or burnt-over ground or occupying the sunny shores of streams, lakes and swamps. Although some, like Elderberry and Jerusalem Artichoke, prefer rich, moist soils, almost all species will do well on loose—textured soil.

It is important to note that the important criteria of plentiful sunlight can often be created as a result of early man's activities. Forest fires for instance, whether ignited by mistake or on purpose, often result in providing a suitable habitat. Wood-cutting activities, or land clearing for horticultural purposes, would produce these habitats close to recurring site locations. Periodically flooded soil, especially flood plains of bottom lands, is also beneficial to some species, notably Goosefoot and Pigweed (*Chernopodium* and *Amaranthus*).
Density

As before, there are two aspects of density: overall distribution and aggregation size.

The overall distribution of these species cannot be considered high, but they were relatively common as some are present in pollen sequences (although they are not always counted and presented on the pollen diagrams). Unfortunately, specific statistics are not available in this respect.

The aggregation size, however, is commonly very high among these species, especially for Goosefoot and Pigweed (seeds), and Elderberry (fruit). Other fruits could have a very high aggregation size in suitable locations, and would be utilized locally.

Among the root plants the Jerusalem Artichoke would usually have the largest aggregation size, if only because it is tuberous.

Weight of Crop Measure

There are no specific figures in this respect and it is a difficult attribute to discuss in general terms, as the crop measure clearly varies with the density. Certainly in areas where a species is highly aggregated, large weights and quantities could be collected in a very short time, regardless of species. However, some species, like Blackberry (Rubus) and Strawberry (Fragaria), cannot aggregate as tightly as Elderberry or Grape.

Utilizing Terrestrial Plants

The roots of Jerusalem Artichoke and Evening Primrose are cooked as potatoes and require no preparation other than cleaning and peeling or slicing. There is no information about these roots being used for flour, nor about their storable qualities for, although they may have been dried, they probably would be stored for a while after the fashion of potatoes.

The seeds of various species were used as a meal in soup or gruel, and could be ground to flour to use for breadstuffs. Seeds, of course, have great storable qualities.
The fruits of various species can all be dried easily, either individually or as "leather", and are easily reconstituted later for use in pudding or flavouring or as a sweet chew. When fresh, most fruits are eaten out of hand or stewed. Chokecherry and especially Elderberry are farinaceous and are used as such for breadstuffs.

The leaves, flowers and shoots of some species are excellent as potherbs, either as a spinach or as a component of stew.

**Food Quality**

The quality of these species is great, however, Goosefoot and Pigweed are especially nutritious, for they contain protein, carbohydrates and perhaps oil. Roots are high in carbohydrates and minerals; fruits contain fructose and vitamins and carbohydrates. Greens are good sources of vitamins and sometimes carbohydrates.

**Season of Availability**

The roots of the Evening Primrose and Jerusalem Artichoke are best gathered as late in the fall as possible for they are very starchy at that time and less "peppery".

Seeds are ready to gather in the fall months, but Goosefoot and Pigweed are notable because they can retain their seeds into early winter, thus making them available for a long period of time.

**Terrestrial Plant Efficiency**

In terms of overall efficiency, the seeds of Goosefoot and Pigweed undoubtedly score high due to their nutritiousness, high density and long period of availability.

Some species of fruit, notably Elderberry, Grape, Chokecherry and Sandberry and Serviceberry, are next in efficiency (their order depending upon local distribution).
Blackberry and Strawberry are only slightly lower in efficiency, as they require a little more work to pick. In areas of high local distribution Blackberry may be more efficient as it is also available over a long period of time.

The roots are next in efficiency. Of these, Jerusalem Artichoke is probably most efficient as it is tuberous. The overall efficiency of the terrestrial tubers and root-stokes compared to aquatic is difficult to assess, but the aquatic species have some advantage because they have a higher density, are versatile in their use (both farinaceous and potato-like) and would be more accessible to waterside recurring camps. Evening Primrose and Jerusalem Artichoke would have a higher efficiency in localities of high distribution or, more probably, in later cultures after the introduction of agriculture as both species were domesticated by agrarian people.
FISH SPECIES OF PRINCE EDWARD

The following are not the only species available but are considered to be the main species likely to be exploited in Prince Edward. They are:

Lake Sturgeon Acipenser Fulvescens
Long - Nose Gar Lepisosteus Osseus
Bowfin Amia Calva
Atlantic Salmon Salmo Solar
Lake Trout Salvelinus Namaycush
Lake Whitefish Coregonus Clupeaformis
Round Whitefish Prosopium Cylindraceum
Shallow - water Ciscoe Coregonus Arctedii
Smelt Osmerus Mordax
White Sucker Catostomus Sommersoni
Mullet Catostomus ?
Yellow, Black and Brown Ictalurus Nebulosus, Ictalurus Natalis, Ictalurus Melas
Bullheads
Chain Pickerel Esox Niger
Northern Pike Esox Lucius
Maskinonge Esox Masquinangy
White Bass Roccus Crysops
Yellow Perch Perca Flavescens
Yellow Walleye Stizostedion Vitreum Vitreum
Small - Mouth Bass Micropterus Dolomieu
Large - Mouth Bass Micropterus Salmoides
Sunfish Lepomis Gibbosus
Rock Bass Ambloplitus Rupestris
Black Crappie Pomoxis Nigromaculatus
Alewife Alosa Pseudoharengus
Gizzard Shad Dorosoma cepedianum
Mooneye Hiodon Tergius
Freshwater Drum Aplodinotus Grunniens
Habitat and Habits

There are three major habitats utilized by the above species: (a) deep water (i.e. over 40 feet deep), (b) deep water and shoals, seasonally, and (c) shoal waters.

Those species inhabiting deep water (and therefore only available in their spawning runs up tributary streams and rivers) are: Salmon, Smelt, Mullet and Alewife.

Those species living in deep water or shoals depending upon the season, are: Lake Trout, Ciscoes, Whitefish, White Bass and Maskinonge. These species, then, are available twice during the year: Once at spawning (most species in shoals) and again when they feed close to shore (usually late fall or early spring when the water is cold).

Those species occupying shoal waters the year round are: Sturgeon, Gar, Bowfin, Sucker, Bullhead, Perch, Walleye, Small-Mouth Bass, Large-Mouth Bass, Gizzard Shad, Moon-eye, Pike, Pickerel, Freshwater Drum, Sunfish, Rock Bass, and Black Crappie. Of these 17 fish, four are absent for some period spawning in the tributary waters (Sturgeon, Sucker, Mooneye, and Walleye). The other 13 spawn in shallow water. Most of the above move into the deepest part of their habitat in the winter.

Within these broad habitats, of course, each species seeks its own preferred conditions. For instance, Salmon can enter rivers at any time of the year if the flow and temperature are suitable; and Smelt sometimes congregates in tributary mouths for a while before its spawning run. In the shoals, the Gar, Pike, Maskinonge, Bowfin and Large-Mouth Bass like areas of heavy vegetation, especially Cattail and Lily pads. Walleyes and Small-Mouth Bass and Rock Bass prefer hard rock or gravel bottoms, while bottom feeders like Gizzard Shad, Drum, Sucker, Bullhead and Sturgeon prefer mud bottoms. Lake Trout frequents the shoals early in the spring before the water warms, and White Bass migrate in large schools into the mouths of tributaries and into tailwaters. Maskinonge and Whitefish both inhabit the shoals in early spring and late fall when the water is cold.
Season of Availability

Although some fish are available the year round, others are only available when they spawn. Generally, all species are most available at this time, even the year round varieties. Most fish spawn or run in the spring, although several important species are fall spawners. During the summer almost no fish spawn and any fishing at this time would have to be off the year-round shoal species. During the spring, however, from run until the end of May, 15 of the foregoing species spawn one after another and sometimes simultaneously, in streams, rivers or lakes. For instance Sucker and Walleye use the same spawning grounds at the same time, Suckers during the day and Walleye at night.

Most lake spawners are known to prefer sand and gravel bottoms in beach areas as spawning grounds. These species are: Whitefish, Ciscoe, Smelt, White Bass, Small-and Large-Mouth Bass, Sunfish, Crappie, Rock Bass, Alewife and Drum.

Most stream spawners, too, prefer shallow, gravelly riffles below waterfalls, although Sturgeon and Smelt use relatively deep waters.

Those species spawning at night are: Bowfin, Salmon, Lake Trout, Whitefish, Smelt, Perch, and Mooneye. The rest spawn during the day.

Sunfish, Rock Bass, Crappie, Small and Large Mouth Bass are nest-builders and remain localized in these areas. Most other species spawn in schools, often quite dense, in the shallow waters.

The length of the spawning period varies from a few days to a few weeks.

Aggregation Size

Those species which are pelagic or school-forming clearly have the largest aggregation size, especially during the spawning period. Pelagic species include: Whitefish, Ciscoe, Smelt, White Bass, Alewife, Gizzard Shad and Mooneye.
Other species do not form large dense schools but are commonly found in loose schools: Bullhead, Perch, Walleye, Sunfish, Rock Bass and Black Crappie.

Sturgeon, Small-Mouth Bass, Sucker, and Freshwater Drum are often found in loose groups, but Gar, Bowfin, Lake Trout, Large-Mouth Bass, Pike, and Maskinonge are, however, usually isolated "hunters".

Clearly the normal aggregation size of all species is much greater during spawning.

Fish Food

Only the Gizzard Shad is believed to be solely vegetarian, while many other species subsist on both small animals and plants. Among these are: Bullheads, Smelt, Sunfish, Rock Bass, Crappie, Alewife, Mooneye, Sturgeon, Whitefish, Ciscoe, and Sucker.

Some fish, while often dependent upon plant food as fry, are solely carnivorous as adults: White Bass, Small-Mouth Bass, Large-Mouth Bass, Perch, Walleye, Pike, Maskinonge, Pickerel, Gar, Bowfin, Salmon, Lake Trout and Freshwater Drum.

Weight

The varieties of fish considered available are listed below according to the rough order of their average weight.

<table>
<thead>
<tr>
<th>Fish</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sturgeon</td>
<td>25 lbs.</td>
</tr>
<tr>
<td>Drum</td>
<td>20 lbs.</td>
</tr>
<tr>
<td>Whitefish</td>
<td>15 lbs.</td>
</tr>
<tr>
<td>Maskinonge</td>
<td>12 lbs.</td>
</tr>
<tr>
<td>Lake Trout</td>
<td>4 lbs.</td>
</tr>
<tr>
<td>Salmon</td>
<td>3 lbs.</td>
</tr>
<tr>
<td>Pike</td>
<td>3 lbs.</td>
</tr>
<tr>
<td>Mullet</td>
<td>3 lbs.</td>
</tr>
<tr>
<td>Large-Mouth Bass</td>
<td>3 lbs.</td>
</tr>
<tr>
<td>Bowfin</td>
<td>2.5 lbs.</td>
</tr>
<tr>
<td>Gar</td>
<td>2.5 lbs.</td>
</tr>
<tr>
<td>Fish</td>
<td>Weight</td>
</tr>
<tr>
<td>-----------------</td>
<td>--------</td>
</tr>
<tr>
<td>White Bass</td>
<td>2.25 lbs.</td>
</tr>
<tr>
<td>Sucker</td>
<td>1.5 lbs.</td>
</tr>
<tr>
<td>Bullhead</td>
<td>1.5 lbs.</td>
</tr>
<tr>
<td>Perch</td>
<td>.75 lbs.</td>
</tr>
<tr>
<td>Ciscoe</td>
<td>.75 lbs.</td>
</tr>
<tr>
<td>Gizzard Shad</td>
<td>.75 lbs.</td>
</tr>
<tr>
<td>Mooneye</td>
<td>.75 lbs.</td>
</tr>
<tr>
<td>Sunfish</td>
<td>.50 lbs.</td>
</tr>
<tr>
<td>Rock Bass</td>
<td>.50 lbs.</td>
</tr>
<tr>
<td>Crappie</td>
<td>.50 lbs.</td>
</tr>
<tr>
<td>Alewife</td>
<td>.25 lbs.</td>
</tr>
<tr>
<td>Smelt</td>
<td>.12 lbs.</td>
</tr>
</tbody>
</table>

The average weight of most of these species has been obtained by averaging the average weights given in printed sources. Many species, however, like Sturgeon, Drum, Salmon, Lake Trout and Whitefish, were formerly much larger as historical records indicate; the weight of these species, therefore, has been estimated, rather conservatively perhaps, but the order of these latter species is probably presented correctly.

The Efficiency of Fish

If we assume that those fish species with the greatest aggregation size and/or weight are the most efficient and therefore most important, we can determine the following:

**Weight:** Sturgeon, Drum, Whitefish, Lake Trout, Salmon, Maskinonge, Pike and Mullet.

**Aggregation Size:** All stream spawners have a high aggregation size, but the highest would surely be for those stream spawners which are also pelagic or school-forming. In this respect, the highest could be: Whitefish, Mullet/Sucker, Smelt, and Mooneye, and Sturgeon.

When these two attributes are combined, the overall efficiency might be more like: Sturgeon, Whitefish, Salmon, Drum, Mullet/Sucker; Smelt, Mooneye, and Gizzard Shad.
THE SUB-DRAINAGE UNITS

The sixteen sub-drainage units are described according to area, soil drainage, streams, swamps, marshes, topography, parent material, surface reaction, stoniness, depth to bedrock and capability for ungulates. These aspects are summarized for each shore: west, east and north, and four interior areas.

It should be noted that these sub-drainage units were chosen in a somewhat arbitrary fashion for although the intention was to create "natural" sub-units, it was necessary to decrease the area of some watersheds and lump other ones together. For instance, Consequon drainage really includes all of Weller's Bay, Consequon-Allisonville and Big Swamp, while the Hillier sub-drainage unit is really made of over three systems. This arbitrary boundary fixing was necessary in order to maintain comparable areas, for if natural basins only were followed it would be necessary to compare all of the Consequon drainage (88.2 square miles) to Hillier creek, a much tinier system immediately below it. Even with the present arrangement we have small units like Rednersville (8.2 square miles), and South Bay (7.5 square miles). Thus, for convenience of areal synthesis the author decided to combine the sub-drainages into the three shorelines and four interior regions.

As valuable and useful as these regions may be, there are several misleading concepts which tend to seduce the researchers:

1. The physiographic unit, or region, is not an entity or organism unto itself, and cannot be accurately delimited.

2. When contrasting one region to another, one must keep in mind that human life is not entirely a function of environment, and there is more to settlement patterns than food and shelter.

These factors must be taken into consideration, especially when discussing the north shore and part of the east shore, for the true physiographic sub-unit includes both sides of the Bay of Quinte and since these areas of Hastings and Lennox & Addington counties have not been inventoried or environmentally studied, we are clearly perceiving parts of Prince Edward with a serious bias.
The Sub-Drainage Units of Prince Edward
Areas of High Settlement Aggregation in Prince Edward
Threatened Sites in Prince Edward
The north side of North Marysburgh and the southern arm of Bid Island-Green Point are good examples of this, for both were utilized lightly in prehistoric times and appear less inviting than other areas in the county, whereas they should really be taken in account with the Hay Bay region of Adolphustown, as well-known area for reported archaeological finds.

The West Shore

The west shore includes: Wellers Bay, Hillier, West Lake, East Lake and Athol. It totals 145.7 square miles and is the largest of the 4 regions. It is predominantly well drained (110 square miles), and has the second largest area of swamp (5.0 square miles), and marsh (7.3 square miles). There are at least 22 stream miles. The topography is quite rolling in some areas of the west shore, more so than the other shores. Although the drainage is mostly good, there is considerable imperfectly drained soil around Wellers Bay. The parent material is mostly shallow limestone till (grey calcareous soft claystone), although there is, glacial-fluvial and outwash material in a fan-area covering West and East Lake to Picton Bay. Occasional areas of deeper limestone tills occur as well. The surface reaction is alkaline, with some neutral to slightly acid reactions. Most soils are stony, some very stony, but a few are stone-free. Most soils are less than or equal to 2.5 feet in depth, but there is a good distribution of deeper soils (over 3 feet to bedrock), and a little of shallow soil less than 1 foot in depth. The overall capability for ungulates in the west shore is 3.5.

East Shore

This shore includes: South Marysburgh, South Bay, North Marysburgh and Picton-Glenora. The total area is the smallest at 63 square miles. Of this, 54.7 square miles is well drained. The east shore has the second smallest marsh area and the smallest swamp area. There are over 18 streams, totalling over 36 stream miles which is the lowest length of stream miles. The topography is mostly level to undulating, although some rolling land does occur. Much of the shore line, especially the north and east is steeply precipiced. The soil is mostly well drained and formed from shallow limestone till, derived from blue very fine hard brittle limestone and blue-grey fine crystalline limestone with shale. Some soil was formed from lacusto-marine and outwash deposits. About half the soils are alkaline, while the other half are
neutral to slightly acid; the surface is mostly stony with a little soil free from stones or with only a few stones. Most soils are only 2.5 feet deep and some are as shallow as 1 foot. There is a little soil, however, over 3 feet deep. The average capability for ungulates is 3.3, the second highest in Prince Edward.

North Shore

This shore is the second smallest in Prince Edward, with an area of 73.7 square miles; with only 49.9 square miles being well drained this shore has the greatest area of poorly drained land (poor and imperfect drainage). Although the swamp area is second lowest at 2.2 square miles, the marsh area is the highest at 7.8 square miles. Over 25 streams total over 40 stream miles, which is the second lowest length in Prince Edward. The topography is mostly level, with some rolling and undulating land, with occasional slopes of $5^\circ - 10^\circ$. The imperfectly drained land is outstanding but is well mixed with well-drained soils.

Most soils were formed from lacusto-marine deposits, although these are some deeper limestone tills and some shallow tills formed from blue-gray crystalline limestone with shale. The surface reaction is slightly acidic to alkaline, and the soil is half stony and half stone-free. Most soil is over 3 feet deep, but a little is less than 2.5 feet and a little less than 1 foot. The overall capability for ungulates is 2.6, the highest in Prince Edward.

The Interior

The interior is made up of Conseen-Allisonville, Big Swamp, Fish Lake and Black River, which total 117 square miles in area, the second highest region in Prince Edward. Most of this land is well drained (91.9 square miles), and the swamp area is the highest at 13.6 square miles with the marsh the lowest at 1.8 square miles. There are only about 15 streams, but they total over 67 stream miles, the second highest length. The topography is mostly level, with a little undulating ground.

Most soils are well drained and are shallow limestone tills formed from blue, very fine, hard brittle limestone and have an alkaline surface reaction. The soils are mostly
stony and mostly less than 2.5 feet deep, often less than 1 foot. The overall average capability for ungulates is 3.7, the lowest in Prince Edward.
THE SUB - DRAINAGE UNITS - DESCRIPTION

1. WELLERS BAY

Soil Proportion by Drainage

<table>
<thead>
<tr>
<th></th>
<th>Area</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Area</td>
<td>14.1 square miles</td>
<td>100.0</td>
</tr>
<tr>
<td>Total Well-Drained</td>
<td>9.7 square miles</td>
<td>68.7</td>
</tr>
<tr>
<td>Total Poorly-Drained</td>
<td>4.4 square miles</td>
<td>31.0</td>
</tr>
<tr>
<td>Poor</td>
<td>1.6 square miles</td>
<td>11.3</td>
</tr>
<tr>
<td>Imperfect</td>
<td>1.6 square miles</td>
<td>11.3</td>
</tr>
<tr>
<td>Swamp</td>
<td>.4 square miles</td>
<td>3.0</td>
</tr>
<tr>
<td>Marsh</td>
<td>.7 square miles</td>
<td>5.0</td>
</tr>
</tbody>
</table>

Streams

There are four short streams averaging 2.25 miles in length for a total of 9 stream-miles. The topography is generally level to slightly undulating so the streams' drop would not be great.

Bodies of Water

Wellers Bay is approximately 5 square miles and is quite shallow. No Conservation Authority maps are available. The bar of Eastport sand which divides Wellers Bay from Lake Ontario was once, within living memory, much more developed with vegetation. Thus the bay would have been more sheltered in the past although the water is quite expansive.

Soil Series

<table>
<thead>
<tr>
<th>Poor</th>
<th>Gerow Clay</th>
</tr>
</thead>
<tbody>
<tr>
<td>Imperfect</td>
<td>Tecumseth Sandy Loam</td>
</tr>
<tr>
<td>Good</td>
<td>Ameliasburgh Clay Loam;</td>
</tr>
<tr>
<td></td>
<td>Hillier Clay Loam</td>
</tr>
</tbody>
</table>
Description Based on Soil Maps

The topography is level to slightly undulating and the slope very slight. About 1.6 square miles is imperfectly drained and is still mostly wooded. As well there is about 1.6 miles of poorly-drained land still largely wooded. The well-drained land comprises over 9 square miles and is mostly cleared today.

The present woodlot forest composition is white cedar and elm on the imperfect soil, soft maple and elm on the poorly-drained and elm, maple, ironwood and red cedar.

The surface reaction varies from about neutral in the imperfect series to alkaline in the others.

The well-drained ground being light drift over bedrock is the shallowest for the limestone may be as little as 2 feet below the surface. The poorly-drained ground too is as shallow as 3 feet over bedrock. Only the imperfect series has more than 3 feet of drift over bedrock.

Contemporary Land Capability for Ungulates

The north shore of Wellers Bay (Con. 2 and 3 Ameliasburgh) is Class 3 or an area of moderately high capability, the main restriction being excessive soil moisture and excessively shallow soil, curtailing the rooting zone of some plants. The south shore, too, is rated Class 3 with the major restriction being excessive soil moisture. Bald Head Island is rated Class 4 or moderately high limitations, the limitations being poor distribution of landforms.
2. HILLIER

Soil Proportion by Drainage

<table>
<thead>
<tr>
<th>Area</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Area</td>
<td>100.0</td>
</tr>
<tr>
<td>Total Well-Drained</td>
<td>84.0</td>
</tr>
<tr>
<td>Total Poorly-Drained</td>
<td>15.6</td>
</tr>
<tr>
<td>Poor</td>
<td>3.1</td>
</tr>
<tr>
<td>Imperfect</td>
<td>0.8</td>
</tr>
<tr>
<td>Swamp</td>
<td>8.5</td>
</tr>
<tr>
<td>Marsh</td>
<td>3.3</td>
</tr>
</tbody>
</table>

Streams

There are five main streams totalling approximately 28 stream-miles. Most notable are: Hillier, about 5.5 miles long with a drop of 70 feet and Hubbs Creek almost 10 miles long with a drop of 80 feet.

Bodies of Water

North Bay, Pleasant Bay and Huyck Bay, together make about 2 square miles of enclosed shallow water. Conservation Authority maps showing depth and vegetation density are available only for the last two.

Soil Series

Poor

Gerow Clay

Imperfect

Solmesville Clay; Elmbrook Clay

Good

Ameliasburgh Clay Loam; Hillier Clay and Clay Loam, Brighton Gravelly sand.
Description Based on Soil Maps

The two most common series in Hillier are Hillier and Ameliasburgh. These well-drained soils vary from slightly undulating to strongly rolling in topography. Most land is cleared, the remaining woodlots (uneven, grazed, cut-over, poorly stocked) contain elm, maple, beech, red cedar and ironwood. The surface reaction is generally alkaline. Both series are extremely shallow tills over bedrock, less than 2 to 2.5 feet. The soil is often very stony.

Contemporary Capability for Ungulates

All of Hillier is classed as 3, or an area with slight limitations and a moderately high capability; the biggest limitation is excessive soil moisture (swamps) and shallow soil depth (especially below Consecon Marsh).
3. WEST LAKE

Soil Proportion by Drainage

<table>
<thead>
<tr>
<th></th>
<th>Area</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Area</td>
<td>44.0 miles</td>
<td>100.0</td>
</tr>
<tr>
<td>Total Well-Drained</td>
<td>34.4 miles</td>
<td>78.2</td>
</tr>
<tr>
<td>Total Poorly-Drained</td>
<td>9.6 miles</td>
<td>21.8</td>
</tr>
<tr>
<td>Poor</td>
<td>1.25 miles</td>
<td>2.8</td>
</tr>
<tr>
<td>Imperfect</td>
<td>4.9 miles</td>
<td>11.1</td>
</tr>
<tr>
<td>Swamp</td>
<td>.99 miles</td>
<td>2.2</td>
</tr>
<tr>
<td>Marsh</td>
<td>2.4 miles</td>
<td>5.5</td>
</tr>
</tbody>
</table>

Streams

Five major creeks total approximately 30 stream-miles. Most notable is Lane Creek falling over 90 feet in 5 miles and Waring Creek, also falling over 90 feet in 5 miles, and Bloomfield Creek which is over 10 miles in length.

Bodies of Water

West Lake is over 6 square miles in area and is quite shallow, with both sheltered areas and open expanses.

Soil Series

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor</td>
<td>Gerow Clay</td>
</tr>
<tr>
<td>Imperfect</td>
<td>Elmbrook Clay</td>
</tr>
<tr>
<td>Good</td>
<td>Ameliasburgh Clay-Loam, Hillier Clay Loam, Percy Sandy Loam, Ponty Pool Sandy Loam, Brighton Sandy Loam</td>
</tr>
<tr>
<td>Excessive</td>
<td>Eastport Sand</td>
</tr>
</tbody>
</table>
Description Based on Soil Maps

The three most commonly found series in West Lake are Pontypool, Percy and Brighton. All are well-drained. Pontypool formed fluvial-glacial material and the others form outwash materials. The topography varies from rolling (Pontypool with 5° to 15° slopes) to level or undulating (Brighton). The surface reaction is slightly acid to neutral. Pontypool is a stony soil while the others are stone-free or have few stones. Most of Pontypool is cleared land (there is no information about the others). The present woodlot composition is pine, oak, poplar, maple, chokecherry and elm. Percy is the shallowest soil, often less than 3 feet to bedrock, while the other two have depths over 2 feet.

Contemporary Capability for Ungulates

The areas above Wellington and the southern area of the "peninsula" between West and East Lake are classed as 3 (moderately high capability), with the greatest restriction being deficient soil moisture in the latter and excessive soil moisture (Gerow Clay and Muck) in the former. The Bloomfield area too is rated Class 3 with deficient soil moisture and shallow rooting zone the main limitation. The Brighton Sand along the north shore of Trout Creek is rated slightly lower at 4 (moderate limitations), the main limitations cited as low fertility and deficient moisture. The Sandbanks, quite naturally, are rated lowest, 5, (moderately severe limitations) with deficient soil moisture and low fertility the main reasons.
4. EAST LAKE

Soil Proportion by Drainage

<table>
<thead>
<tr>
<th>Type</th>
<th>Area</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Area</td>
<td>23.1 miles</td>
<td>100.0</td>
</tr>
<tr>
<td>Total Well-Drained</td>
<td>20.0 miles</td>
<td>87.7</td>
</tr>
<tr>
<td>Total Poorly-Drained</td>
<td>3.1 miles</td>
<td>13.4</td>
</tr>
<tr>
<td>Poor</td>
<td>.6 miles</td>
<td>2.8</td>
</tr>
<tr>
<td>Imperfect</td>
<td>1.5 miles</td>
<td>6.5</td>
</tr>
<tr>
<td>Swamp</td>
<td>.1 miles</td>
<td>.65</td>
</tr>
<tr>
<td>Marsh</td>
<td>.9 miles</td>
<td>3.8</td>
</tr>
</tbody>
</table>

Streams

Five streams total about 13 stream-miles. Most notable is the creek emptying into the head of East Lake which is about 5 miles in length and drops rapidly for the first half, and the Cherry Valley Creek which is about 2.25 miles long. The other creeks are very short.

Bodies of Water

East Lake is about 3.5 square miles and is very shallow with many sheltered areas.

Soil Series

<table>
<thead>
<tr>
<th>Type</th>
<th>Soil Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor</td>
<td>Granby Sandy Loam</td>
</tr>
<tr>
<td>Imperfect</td>
<td>Elmbrook Clay and Clay Loam, Tecumseth Sandy Loam</td>
</tr>
<tr>
<td>Good</td>
<td>Farmington Loam, Ameliasburgh Loam, Darlington Loam, South Bay Clay, Brighton Gravelly Sand and Sandy Loam, Percy Fine</td>
</tr>
</tbody>
</table>
Description Based on Soil Maps

Ameliasburgh and Darlington are the two predominant series. Both are well drained and the topography varies from level to strongly rolling (Darlington). The surface reaction varies from neutral to alkaline. The surface is stony and most land is cleared. The remaining woodlots contain elm, maple, ironwood, red cedar and beech. The Ameliasburgh series is shallow till (often less than 2.5 feet) over bedrock. The Darlington is much deeper, deposited as limestone till.

Contemporary Capability for Ungulates

The highest classed area in East Lake is the north shore of East Lake which is classed as 3 (moderately high capability), with deficient soil moisture (droughtiness) as the main limitations. The south shore of East Lake is classed the same, except for the added limitation of shallow soil. The area around Athol is classed as 5 (moderately severe limitations) with low fertility and deficient soil moisture as the main limiting factors.
5. Athol

**Soil Proportion by Drainage**

<table>
<thead>
<tr>
<th>Description</th>
<th>Area</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Area</td>
<td>23.0 miles</td>
<td>100.0</td>
</tr>
<tr>
<td>Total Well-Drained</td>
<td>11.3 miles</td>
<td>75.2</td>
</tr>
<tr>
<td>Total Poorly-Drained</td>
<td>5.7 miles</td>
<td>24.8</td>
</tr>
<tr>
<td>Poor</td>
<td>2.4 miles</td>
<td>10.4</td>
</tr>
<tr>
<td>Imperfect</td>
<td>1.1 miles</td>
<td>4.8</td>
</tr>
<tr>
<td>Swamp</td>
<td>None</td>
<td>-</td>
</tr>
<tr>
<td>Marsh</td>
<td>2.2 miles</td>
<td>9.7</td>
</tr>
</tbody>
</table>

**Streams**

There are three major streams totalling 10.5 stream-miles.

**Bodies of Water**

There are no enclosed bodies of water, although Soup Harbour is quite sheltered. There are no vegetation maps known for this body of water.

**Soil Series**

- Poor: Gerow Clay, Grandy Sandy Loam
- Imperfect: Elmbrook Clay, Tecumseth Sandy Loam
- Good: Farmington Loam, Ameliasburgh Loam, Percy Pind Sandy Loam, Athol Sandy Loam
Description Based on Soil Maps

Farmington and Ameliasburgh are the dominant series in Athol. Both are well drained. The topography is level to slightly undulating, and the surface reaction is alkaline; the soil is stony. Most of the land is cleared and the present forest composition from the woodlots is red cedar, white cedar, elm, maple, and ironwood. Both are extremely shallow soils, underlain by limestone bedrock as little as 1 foot below the surface for Farmington, and 2.5 to 3 feet for Ameliasburgh.

Contemporary Capability for Ungulates

The east part of Athol is classed 3 (moderately high capability) with deficient soil moisture (droughtiness) and shallow soil as the limiting factors. The area around Soup Harbour is classed as 4 (moderate limitations), citing the same factors as above.
6. SOUTH MARYSBURGH

Soil Proportion By Drainage

<table>
<thead>
<tr>
<th></th>
<th>Area</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Area</td>
<td>15.2 square miles</td>
<td>100.0</td>
</tr>
<tr>
<td>Total Well - Drained</td>
<td>13.6 square miles</td>
<td>89.5</td>
</tr>
<tr>
<td>Total Poorly - Drained</td>
<td>1.6 square miles</td>
<td>10.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Type</th>
<th>Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor</td>
<td>nil</td>
</tr>
<tr>
<td>Imperfect</td>
<td>nil</td>
</tr>
<tr>
<td>Swamp</td>
<td>nil</td>
</tr>
<tr>
<td>Marsh</td>
<td>1.6 square miles</td>
</tr>
</tbody>
</table>

Streams

There are two major streams totalling 5.25 miles. The major creek is unnamed and is about 3.75 miles long. There are also several other small creeks less than .75 miles in length.

Bodies Of Water

There are no significant embayments or other bodies of water. Most of South Marysburgh's shoreline is rough and exposed.

Soil Series

Good: Farmington Loam, South Bay Clay
Description Based On Soil Maps

The predominant series in South Marysburgh is Farmington and South Bay. Both series are well drained; the topography varies from level to slightly rolling. The surface reaction ranges from alkaline (Farmington) to slightly acid or neutral (South Bay). Farmington is stony but South Bay is stone-free. Most of the land is cleared; the present forest associations are: red cedar, white cedar, elm, maple, ironwood, beech and white ash. Farmington is a very shallow (less than 1 foot) till, over limestone bedrock but South Bay is quite deep, always over 3 feet to bedrock.

Contemporary Capability For Ungulates

All of South Marysburgh is classed as 4 (moderate limitations) citing deficient soil moisture and depth (Farmington Series) as the limiting factors.
7. SOUTH BAY

Soil Proportion By Drainage

<table>
<thead>
<tr>
<th>Type</th>
<th>Area</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Area</td>
<td>7.5 square miles</td>
<td>100.0</td>
</tr>
<tr>
<td>Total Well - Drained</td>
<td>7.0 square miles</td>
<td>90.0</td>
</tr>
<tr>
<td>Total Poorly - Drained</td>
<td>.5 square miles</td>
<td>4.5</td>
</tr>
<tr>
<td>Poor</td>
<td>nil</td>
<td>-</td>
</tr>
<tr>
<td>Imperfect</td>
<td>.3 square miles</td>
<td>2.5</td>
</tr>
<tr>
<td>Swamp</td>
<td>nil</td>
<td>-</td>
</tr>
<tr>
<td>Marsh</td>
<td>.2 square miles</td>
<td>2.0</td>
</tr>
</tbody>
</table>

Streams

One stream of 3 miles in length flows into the head of South Bay. There are several other very short streams.

Bodies Of Water

South Bay is about 2.5 square miles in area and is very sheltered and quite shallow in places.

Soil Series

Imperfect

Tecumseth Sandy Loam, Elmbrook Clay

Good

South Bay Clay, Ameliasburgh Clay and Clay Loam, Waupoos Clay, Brighton Sand, Percy Fine Sandy Loam, Athol Sandy Loam.
Description Based on Soil Maps

The most common series is Ameliasburgh but there are many other well-drained sandy loams present, including Athol and Brighton. Much of the shoreline is South Bay clay. The topography is level to undulating and all soils are well drained. Most of the land is cleared and common woodlot species include elm, maple, ironwood, red cedar, oak, pine, poplar and chokecherry. The surface reaction varies from slightly acid to alkaline and from stony to few stones. Ameliasburgh and Athol are shallow till soils, not much over 2 feet in depth, but Brighton, an outwash parent, and South Bay, a lacusto-marine parent, are over 3 feet deep.

Contemporary Capability for Ungulates

All of South Bay is classed as 3, an area of moderately high capability with slight limitations, namely: shallow soil and deficient soil moisture.
8. NORTH MARYSBURGH

Soil Proportion By Drainage

<table>
<thead>
<tr>
<th>Type</th>
<th>Area</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Area</td>
<td>25.1 miles</td>
<td>100.0</td>
</tr>
<tr>
<td>Total Well - Drained</td>
<td>20.8 miles</td>
<td>82.6</td>
</tr>
<tr>
<td>Total Poorly - Drained</td>
<td>4.4 miles</td>
<td>17.4</td>
</tr>
<tr>
<td>Poor</td>
<td>.5 miles</td>
<td>1.8</td>
</tr>
<tr>
<td>Imperfect</td>
<td>2.7 miles</td>
<td>10.8</td>
</tr>
<tr>
<td>Swamp</td>
<td>.4 miles</td>
<td>1.8</td>
</tr>
<tr>
<td>Marsh</td>
<td>.7 miles</td>
<td>3.0</td>
</tr>
</tbody>
</table>

Streams

Eleven small streams empty into Prince Edward Bay and Adolphus Reach. Most notable is Waupoos Creek with 7 stream - miles and Cressy Creek with 4 stream - miles. The remaining 9 streams are about a mile each, bringing the total stream - miles to 21.

Bodies Of Water

Lake-on-the-Mountain is the only body of water. It is very deep and lies at the top of an escarpment a short distance from the long Reach.

Soil Series

- Poor                  Gerow Clay
- Imperfect             Solmesville Clay, Elmsbrook Clay Load
- Good                 Ameliasburgh Clay Loam and Loam, South Bay Clay, Waupoos Clay, Farmington Loam, Percy Fine Sandy Loam and Brighton Sandy Loam
Description Based On Soil Maps

The two main series in North Marysburgh are Ameliasburgh and Farmington. Both are well drained with level to slightly undulating topography. The surface reaction is alkaline and the land is stony and mostly cleared. Tree species from woodlots include predominantly red cedar, white cedar, elm, maple and ironwood. Both soils are extremely shallow, underlain by limestone bedrock at as little as 1 foot (Farmington) and 2 feet (Ameliasburgh).

Contemporary Capability For Ungulates

The Morrison's Point area is classed as 3 (moderately high capability) with soil shallowness and moisture deficiency as the limiting factors. Waupoos Island is rated as 2, a high capability area, with very slight restrictions in the soil shallowness category. East of the fault line at Cape Vesey is rated as Class 2, as well citing soil moisture as the limiting factor (probably both deficiency and exessivity). The south side of the peninsula - base is classed as 3 (moderately high capability), citing soil shallowness and moisture (deficiency and exessivity) as the limiting factors. The north side of the peninsula is rated lower at 4 (moderate limitations) citing the same limiting factors.
Soil Proportion By Drainage

<table>
<thead>
<tr>
<th>Type</th>
<th>Area</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Area</td>
<td>15.2 square miles</td>
<td>100.0</td>
</tr>
<tr>
<td>Total Well - Drained</td>
<td>13.3 square miles</td>
<td>87.4</td>
</tr>
<tr>
<td>Total Poorly - Drained</td>
<td>1.9 square miles</td>
<td>12.5</td>
</tr>
<tr>
<td>Poor</td>
<td>.2 square miles</td>
<td>1.1</td>
</tr>
<tr>
<td>Imperfect</td>
<td>1.5 square miles</td>
<td>10.0</td>
</tr>
<tr>
<td>Swamp</td>
<td>.2 square miles</td>
<td>1.3</td>
</tr>
<tr>
<td>Marsh</td>
<td>nil</td>
<td>-</td>
</tr>
</tbody>
</table>

Streams

Four small streams make a total of about 8 stream-miles. Most notable is Picton Creek and the stream flowing into the west shore of Picton Bay.

Bodies Of Water

Picton Bay is about 1.5 square miles in area and is very deep with steep shores.

Soil Series

<table>
<thead>
<tr>
<th>Type</th>
<th>Soil Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor</td>
<td>Grandy Sand</td>
</tr>
<tr>
<td>Imperfect</td>
<td>Elmbrook Clay</td>
</tr>
<tr>
<td>Good</td>
<td>Ameliasburgh Loam and Clay Loam, Darlington Loam, Farmington Loam, Percy Fine Sandy Loam, Pontypool Loam</td>
</tr>
</tbody>
</table>
Description Based on Soil Maps

Farmington and Ameliasburgh are the most common series in Picton-Glenora. Both are well drained with level to slightly undulating topography. The surface reaction is alkaline and the land is stony and mostly cleared. Woodlot species include red cedar, white cedar, elm, maple, iron-wood. Both series are extremely shallow tills with the bedrock as little as 1 or 2 feet below the surface.

Contemporary Capability for Ungulates

South of Picton Bay, towards Glenora is classed as 4 (moderate limitations) citing soil fertility and moisture deficiency. The north side of the Bay, towards Elmbrook, is more highly rated at 3, citing excessive soil moisture and shallowness as slight limiting factors.
10. BIG ISLAND

Soil Proportion By Drainage

<table>
<thead>
<tr>
<th>Area</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Area</td>
<td>27.8 square miles</td>
</tr>
<tr>
<td>Total Well - Drained</td>
<td>19.1 square miles</td>
</tr>
<tr>
<td>Total Poorly - Drained</td>
<td>8.7 square miles</td>
</tr>
<tr>
<td>Poor</td>
<td>.2 square miles</td>
</tr>
<tr>
<td>Imperfect</td>
<td>6.4 square miles</td>
</tr>
<tr>
<td>Swamp</td>
<td>.1 square miles</td>
</tr>
<tr>
<td>Marsh</td>
<td>2.0 square miles</td>
</tr>
</tbody>
</table>

Streams

There are 14 streams totalling over 14 stream-miles. Few of these are over 1 mile in length.

Bodies Of Water

Muscote Bay is a shallow sheltered bay of over 3 square miles.

Soil Series

Poor: Gerow Clay

Imperfect: Solmesville Clay, Elmbrook Clay

Description Based on Soil Maps

Elmbrook, Darlington and Farmington are the predominant series. The first is imperfectly drained, the last two are well drained. The topography varies from level (Farmington and Elmbrook) to strongly rolling (Darlington). The surface reaction varies from slightly acid to neutral (Elmbrook) to alkaline (Farmington). Elmbrook is a stone-free series but the others are quite stony. Most land is cleared and woodlot species include red cedar, white cedar, sugar maple, beech, elm and ironwood. Farmington is a shallow till often less than 1 foot over bedrock, but the others are quite deep, especially the Darlington Series.

Contemporary Capability For Ungulates

All of Big Island, including Green Point and the "south arm" along the Long Reach, is classed as 3, citing soil shallowness and moisture deficiency as limiting factors.
11. SAWGUIN CREEK

Soil Proportion By Drainage

<table>
<thead>
<tr>
<th>Area Description</th>
<th>Area</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Area</td>
<td>37.7 square miles</td>
<td>100.0</td>
</tr>
<tr>
<td>Total Well - Drained</td>
<td>23.2 square miles</td>
<td>61.6</td>
</tr>
<tr>
<td>Total Poorly - Drained</td>
<td>14.5 square miles</td>
<td>38.4</td>
</tr>
<tr>
<td>Poor</td>
<td>.1 square miles</td>
<td>.2</td>
</tr>
<tr>
<td>Imperfect</td>
<td>6.9 square miles</td>
<td>18.4</td>
</tr>
<tr>
<td>Swamp</td>
<td>2.1 square miles</td>
<td>5.5</td>
</tr>
<tr>
<td>Marsh</td>
<td>5.4 square miles</td>
<td>14.4</td>
</tr>
</tbody>
</table>

Streams

Consecon Creek has many tributaries and together with two other smaller creeks over 20 miles of stream-miles are present.

Bodies Of Water

Muscote Bay is shared by Sawguin and Big Island.

Soil Series

<table>
<thead>
<tr>
<th>Type</th>
<th>Soil Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Imperfect</td>
<td>Elmbrook Clay, Tecumseth Sandy Loam</td>
</tr>
<tr>
<td>Good</td>
<td>Farmington Loam, Brighton Gravel-ly Sand, Ameliasburgh Loam and Clay Loam, South Bay Clay Loam, Darlington Loam, Waupoos Clay</td>
</tr>
</tbody>
</table>
Description Based On Soil Maps

The most common series is Elmbrook followed by Darlington and South Bay. The topography varies from level (Elmbrook) to strongly rolling (Darlington). The surface reaction is slightly acid to neutral for Elmbrook and South Bay and neutral to alkaline for the Darlington. South Bay and Elmbrook are stone-free but Darlington is quite stony. Most land is well cleared and some common tree species are sugar maple, beech, elm, white ash, red maple and ironwood. All soils are quite deep, over 3 feet to bedrock. Elmbrook and South Bay are from lacusto - marine material and Darlington is limestone till.

Contemporary Capability For Ungulates

Huff Island and the central and eastern parts of Sawguin - Carrying Place are classed as 3, a moderately high capability area with slight restrictions in the soil moisture (excessivity) and shallowness categories. The north central portion, however, along the Rednersville boundary (on South Bay Clay) is classed as 2, a high capability area, with slight limiting factors with soil moisture.
Soil Proportion By Drainage

<table>
<thead>
<tr>
<th>Type</th>
<th>Area</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Area</td>
<td>8.2 square miles</td>
<td>100.0</td>
</tr>
<tr>
<td>Total Well - Drained</td>
<td>7.1 square miles</td>
<td>86.8</td>
</tr>
<tr>
<td>Total Poorly - Drained</td>
<td>1.1 square miles</td>
<td>13.0</td>
</tr>
<tr>
<td>Poor</td>
<td>nil</td>
<td>-</td>
</tr>
<tr>
<td>Imperfect</td>
<td>.7 square miles</td>
<td>8.2</td>
</tr>
<tr>
<td>Swamp</td>
<td>nil</td>
<td>-</td>
</tr>
<tr>
<td>Marsh</td>
<td>.4 square miles</td>
<td>4.9</td>
</tr>
</tbody>
</table>

Streams

Eight small streams total about 6 stream-miles.

Bodies Of Water

There are no enclosed bodies of water but there are many small sheltered bays along the shore of the Bay of Quinte.

Soil Series

Imperfect

Elmbrook Clay, Tecumseh Sandy Loam.

Good

South Bay Clay Loam, Darlington Loam, Farmington Load, Ameliasburgh Clay Loam, Percy Fine Sandy Loam, Brighton Sandy Loam.
Description From Soil Maps

The predominant series in Rednersville is South Bay and Ameliasburgh. The topography varies from level and slightly undulating to undulating and slightly rolling. Ameliasburgh is alkaline and South Bay is slightly acid to neutral. South Bay is stony-free but Ameliasburgh is stony. Very little land is in woodlot, the most common species are elm, maple, ironwood, red cedar, beech and white ash. Ameliasburgh is a shallow (2 feet) till over bedrock but South Bay is a deeper, lacustor-marine soil, over 3 feet to bedrock.

Contemporary Capability For Ungulates

The central portion of Rednersville, between Ross-more and Rednersville is classed at 2, or high capability area with slight restrictions due to moisture excessivity. The remainder is classed lower at 3 (moderately high capability) with limitations of moisture and soil shallowness.
Soil Proportion By Drainage

<table>
<thead>
<tr>
<th>Area</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Area</td>
<td>42.4 square miles 100.0</td>
</tr>
<tr>
<td>Total Well - Drained</td>
<td>33.6 square miles 79.2</td>
</tr>
<tr>
<td>Total Poorly - Drained</td>
<td>8.8 square miles 20.7</td>
</tr>
<tr>
<td>Poor</td>
<td>2.7 square miles 6.4</td>
</tr>
<tr>
<td>Imperfect</td>
<td>.2 square miles .6</td>
</tr>
<tr>
<td>Swamp</td>
<td>5.0 square miles 11.9</td>
</tr>
<tr>
<td>Marsh</td>
<td>.5 square miles 1.4</td>
</tr>
</tbody>
</table>

Streams

There are 30 miles of stream-length counting Consecon Creek and six of its tributaries. In additions there are three creeks flowing into Lake Consecon.

Bodies Of Water

Consecon Lake is almost 3 square miles and is quite shallow though it has deeper depths than West or East Lake.

Large portions of the Allisonville swamp may once have been inland marshy bodies of water as late as Middleport times, as test pits at the Allisonville site reveal a multitude of fish bones and scales.

Soil Series

| Poor               | Gerow Clay        |
| Imperfect          | Tecumseth Sandy Loam, Elmsbrook Clay |
Good Ameliasburgh Loam and Sandy Loam, Brighton Gravelly Sand, Darlington Loam, Farmington Loam.

Description Based on Soil Maps

Farmington and Ameliasburgh are the most common series in Consecon-Allisonville. Both are well-drained with level to slightly undulating topography. The surface reaction is alkaline and the soil is stony and mostly cleared. Woodlot varieties include red cedar, white cedar, elm, maple, and ironwood. Both series are extremely shallow tills with bedrock as little as 1 to 2 feet below the surface.

Contemporary Capability For Ungulates

The area north of Melville and the shore of Lake Consecon are rated 3 with shallow soil and deficient soil moisture as slightly limiting factors. The swampy area around Allisonville is rated lower at 4 with the same limiting factors, only more severe (moisture excessivity too).
Soil Proportion By Drainage

<table>
<thead>
<tr>
<th>Drainage</th>
<th>Area</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Area</td>
<td>31.7 square miles</td>
<td>100.0</td>
</tr>
<tr>
<td>Total Well - Drained</td>
<td>22.0 square miles</td>
<td>69.4</td>
</tr>
<tr>
<td>Total Poorly - Drained</td>
<td>9.7 square miles</td>
<td>30.6</td>
</tr>
<tr>
<td>Poor</td>
<td>2.7 square miles</td>
<td>8.5</td>
</tr>
<tr>
<td>Imperfect</td>
<td>0.8 square miles</td>
<td>2.5</td>
</tr>
<tr>
<td>Swamp</td>
<td>6.2 square miles</td>
<td>19.5</td>
</tr>
<tr>
<td>Marsh</td>
<td>nil</td>
<td>-</td>
</tr>
</tbody>
</table>

Streams

Six streams feed into the Big Swamp and combined with Consecon Creek they total about 20.5 stream-miles. Consecon Creek itself flows underground for all but 1.5 miles of the 10 mile length.

Bodies Of Water

It is not certain whether the Big Swamp could once have been an inland body of water like the Allisonville swamp because there is a drop of about 50 feet in the 10 miles of swamp. Nor is there any archaeological evidence to suggest this theory. The Big Swamp is nearly 6 square miles.

Soil Series

Poor

Gerow Clay

Imperfect

Elmsbrook Clay

Good

Darlington Loam, Waupoos Clay, Ameliasburgh Loam and Clay, South Bay Clay Loam, Farmington Loam,
Percy Fine Sandy Loam, Hillier Clay

Description Based On Soil Maps

Ameliasburgh and Farmington are the most common series in the Big Swamp. Both are well drained with level to slightly undulating topography. The surface reaction is alkaline and the soil is stony and mostly cleared. Woodlot varieties include red cedar, white cedar, elm, maple and ironwood. Both series are extremely shallow tills with bedrock less than 1 to 2 feet below the surface.

Contemporary Capability For Ungulates

The north side of the Big Swamp proper, in the vicinity of Gilbert Mills, is classed 3, citing shallow soil and deficient moisture as the limiting factors. The northeast section of Big Swamp is rated lower at 4, citing the same factors of limitation. The swamp proper, too, is rated 4 with excessive soil moisture as the major limiting factor.
Soil Proportion By Drainage

<table>
<thead>
<tr>
<th>Drainage</th>
<th>Area</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Area</td>
<td>15.0 sq miles</td>
<td>100.0</td>
</tr>
<tr>
<td>Total Well - Drained</td>
<td>11.7 sq miles</td>
<td>77.9</td>
</tr>
<tr>
<td>Total Poorly - Drained</td>
<td>3.3 sq miles</td>
<td>22.1</td>
</tr>
<tr>
<td>Poor</td>
<td>1.9 sq miles</td>
<td>12.6</td>
</tr>
<tr>
<td>Imperfect</td>
<td>.3 sq miles</td>
<td>1.9</td>
</tr>
<tr>
<td>Swamp</td>
<td>.7 sq miles</td>
<td>4.7</td>
</tr>
<tr>
<td>Marsh</td>
<td>.4 sq miles</td>
<td>2.8</td>
</tr>
</tbody>
</table>

Streams

Demorestville Creek is about 9 miles in length. As well there is another small stream flowing into Fish Lake. Together they total 12 stream - miles.

Bodies Of Water

Fish Lake is approximately .75 square miles and is quite shallow and has dense vegetation.

Soil Series

<table>
<thead>
<tr>
<th>Type</th>
<th>Series</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor</td>
<td>Gerow Clay</td>
</tr>
<tr>
<td>Imperfect</td>
<td>Elmbrook</td>
</tr>
<tr>
<td>Good</td>
<td>Darlington Loam, Ameliasburgh Loam, Farmington Loam</td>
</tr>
</tbody>
</table>
Description Based on Soil Maps

The predominant series in Fish Lake are Ameliasburgh and Farmington. Both are well drained with level to slightly undulating topography. The surface reaction is alkaline and the soil is stony and mostly cleared. Woodlot varieties include red cedar, white cedar, elm, maple and ironwood. Both series are extremely shallow tills with bedrock as little as 1 to 2 feet below the surface.

Contemporary Capability For Ungulates

All of Fish Lake is classed 4, citing shallow soil and deficient soil moisture as limiting factors.
Soil Proportion By Drainage

<table>
<thead>
<tr>
<th>Area Description</th>
<th>Area</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Area</td>
<td>28.0 square miles</td>
<td>100.0</td>
</tr>
<tr>
<td>Total Well - Drained</td>
<td>24.6 square miles</td>
<td>87.8</td>
</tr>
<tr>
<td>Total Poorly - Drained</td>
<td>3.4 square miles</td>
<td>12.1</td>
</tr>
<tr>
<td>Poor</td>
<td>.1 square miles</td>
<td>.5</td>
</tr>
<tr>
<td>Imperfect</td>
<td>1.0 square miles</td>
<td>3.6</td>
</tr>
<tr>
<td>Swamp</td>
<td>1.7 square miles</td>
<td>6.2</td>
</tr>
<tr>
<td>Marsh</td>
<td>.5 square miles</td>
<td>1.8</td>
</tr>
</tbody>
</table>

Streams

The Black River or Creek is a true river and is navigable for the first 9 miles; above Milford however, is another 7.5 miles of stream. There are two other 3 - mile creeks and one 4.5 - miles creek emptying into Black River, making a total of 18 stream - miles.

Bodies Of Water

There are no bodies of water in Black River.

Soil Series

Poor                   Gerow Clay and Brandy Sandy Loam
Imperfect              Elmbrook Clay, Tecumseth Sandy Loam
Good                   Ameliasburgh Loam and Clay Loam,
                        Brighton Sandy Loam, Percy Fine Sandy Loam. Farmington Loam, Darlington Loam.
Description Based On Soil Maps

The predominant series in Black River is Farmington, followed by Ameliasburgh. Both are well drained; the topography is level to slightly undulating (Ameliasburgh) and the surface reaction is alkaline. The land is stony and mostly cleared. The tree species found on woodlots are red cedar, white cedar, elm, maple and ironwood. Both soils are extremely shallow, underlain by limestone bedrock at as little as 1 foot (Farmington) and 2 feet (Ameliasburgh).

Contemporary Capability For Ungulates

All of Black River is classed as 4, an area of moderate limitations namely: deficient soil moisture (droughtiness) and shallow soil.
RATING THE SUB-DRAINAGE UNITS

It is not possible at this time to score the sub-drainage units after the fashion described in section on Methodology, because of the incomplete state of the environment inventory and the lack of specific attribute statistics, like density, weight, aggregation size and mobility for all of the available food resources.

Consequently, it is possible only to rate the sub-drainage units (or shores) in a general fashion according to whether or not the soil depth and drainage, etc., are suitable for the production of these various food-plants and animals.

Nut-Bearing Tree Potential

Those trees with deep taproots (butternut, walnut, shellbark, hickory, white oak and bur oak) would not be able to grow in some sub-drainage units, or would at least have a very low density. Consequently those areas with the deepest soil would support most of these species. Thus the north shore and some of the west shore (West Lake, East Lake), and some of the east shore (South Bay) would have the highest populations of these species.

Furthermore, many species of nut-bearing trees are sun-loving, and are often found on the banks of streams and lakeshores, or the edges of swamps where they are assured of a sunny exposure. Those sun-loving species with large taproots would, of course, be confined to the above mentioned areas, and more specifically along the watersides of those areas.

The remaining sun-loving species, (shagbark and pignut hickory, chinquapins, chestnut-oaks, chincapin-oak, plums and hawthorns) would be found in all sub-drainage units, but especially those with the most stream miles, lake shores and swamp margins. Thus the west shore, particularly West Lake and Hillier, would score very highly in these resources. The interior too, especially Black River and the north shore (particularly Sawguin-Carrying Place) would score quite highly.
The strongly calcareous nature of Prince Edward's limestone bedrock, too, will have an effort upon some species. Chestnut, for instance, does not like limey soil; butternut however, does. More intriguing, because of their high density and efficiency, are chestnut-oaks and chincapin-oaks which thrive on dry, sterile, calcareous soil which is abundant in Prince Edward, especially the interior sub-drainages.

Terrestrial Herbaceous Plant and Fruit Potential

There is very little information about habitat preferences of this group, perhaps because they are no longer economically important as are wood, fish and mammal resources. As with forest trees, the palynological record, if studied completely, should shed much light upon prehistoric species, their habitats and density.

For the time being, however, we are forced to consider sub-drainage potentials in the most general of terms. Many species, (Evening Primrose, Goosefoot, Pigweed, Chokecherry, Sandberry, Strawberry, Milkweed and Raspberry) prefer light textured soils because they are sunnier and more easily disturbed, thus creating better habitats. As with the woody plants mentioned above, most species are sun-loving and often grow beside streams, lakes and swamps where a sunny exposure is afforded. Thus, the west shore, especially West and East Lakes, the shore, especially South Bay and Sawguin on the north shore would probably score highly because of the high incidence of streams, lakes, swamps and glacial-fluvial or outwash soils in those areas.

Aquatic Plant Potential

The environmental assessment of aquatic plants is more complete than most other food resources due, principally, to the vegetation and lake bottom contour map of the Conservation Authority Branch. These maps are available mainly for the bodies of water of the west shore. Maps of the Bay of Quinte and Wellers Bay are not available, (although they may have been mapped). A map of the Muscote Bay-Massassauga Point area would be valuable, as would a map of the South Bay and Waupoos areas.

The west shore, once again, is a prime region for aquatic plants, followed by the north shore (Sawguin, Big Island), and east shore (South Bay and Smith Bay). The interior areas may
once have rated much higher, especially Consecon-Allisonville and Big Swamp, for with a higher water table (due to natural forestation), these swamps may once have been marshes. There is some archaeological evidence to support this for test pits at the Allisonville (Middleport) site on Allisonville Swamp revealed a multitude of fish scales and bones, suggesting a marshy body of water was present at the time of occupation.

Fish Resource Potential

To the author's knowledge there has been very little specific environmental assessment of Prince Edward's fishes.

However, because shallow water, streams and rivers are the best places to catch fish, and because most fish are easily caught during spawning, it is possible to rate certain areas in a general fashion.

River spawners, like Whitefish, Salmon and Sturgeon, may have had limited spawning grounds in Prince Edward because only the first few miles of Black River and Sawguin Creek could afford suitable river spawning grounds for these species. Many fish, however (like Ciscoe, Drum, Bullhead, Pike, Maskinonge, White Bass, Perch and Gizzard Shad), not only inhabit the shoal waters all year or seasonally, but also spawn there, often on sandy beaches. Consequently the west shore, especially West Lake and East Lake and Muscote Bay in the north and south and Smith Bay in the east, all provide suitable spawning grounds. Some river spawners like Sucker/Mullet, Whitefish, Smelt and Sturgeon, also can spawn on beaches, so in Prince Edward, given the lack of rivers, this may have been the case. There are some species like Smelt, Sucker/Mullet and Alewife which can ascend small streams, like those predominant in Prince Edward, and may have been taken there. In this respect the west shore, especially Hillier, may have had the greatest potential.

Mammal Resource Potential

Deer are the only important mammal food resource that has been environmentally considered in Prince Edward. This has been done by A.R.D.A., who have produced a capability
for ungulates map at the 1:50,000 scale. According to this study, the north shore is the highest with a capability of 2.6, followed by the east shore at 3.3. The west shore and interior are rated last as 3.5 and 3.7 respectively. The two present areas of concentration are, north-central Sawguin (class 2), and Waupoos and Waupoos Island (also class 2). Whether or not the contemporary analysis is applicable to prehistoric conditions is a matter of debate, but in accordance with the maxim "the present is a key to the past", the author believes this information to at least be indicative of the earlier situation.

The capability, or potential, of sub-drainage units for beaver could be considered to be in proportion to the number of stream miles and swamps. Thus, Hillier on the west shore and Sawguin-Carrying Place in the north, should score highly for beavers.

Most small game is harder to assess. However muskrats certainly would be numerous in marshy areas where bulrushes and cat-tails are common. (Once again the west shore, Hillier and West Lake, and Sawguin-Carrying Place in the north). Squirrels, too, would be numerous in the fall months in those areas where nut-bearing trees are abundant.

Potential for Non-Food Resources

Firewood resources are extremely important, often crucial, as historical resources have shown. One place where dry standing dead trees (a convenient form of firewood) can be found is in swampy, poorly-drained and periodically flooded areas, or streams subject to beaver damming. Thus the west and north shore areas and the interior might have the highest potential. Another convenient source of wood are storm beaches, which are very common along the western shore facing the prevailing wind.

Certain reeds and aquatic weeds are useful in constructing mats and baskets. These resources are found in the marshy, shallow waters so common everywhere especially the west and north shores.

Lithic resources in Prince Edward are extremely limited. The most important local material may have been a low-grade black chert, found in cobbles form in outwash soils like the Brighton series. Although there is evidence for use of this
material from several sites in Prince Edward, it would seem to be a fortuitous use, as the utilization is highest on sites, like Attersley, which are located on outwash soils. This black chert, then would be most available on the west shore (West Lake and East Lake) and, to a certain extent, on the east shore (South Bay). It is found in small cobbles usually smaller than an egg and often spalled and fractured. It is a poor material to work with and most modified samples consist of bipolar cores and shatter fragments.
THE SITE DISTRIBUTION

As we have seen from the preceding section the areas considered to have the greatest potential for food and manufacturing resources are, in order: west shore, north shore, east shore and interior. This same priority would seem to be apparent in the location of prehistoric sites.

THE WEST SHORE

The west shore distribution is the most interesting because it, and the interior region behind it, comprise 262 square miles, or over 50% of Prince Edward and yet it is safer to speak of the west shore as a "region" than any other shore, because it is isolated by water to the west and south, and does not overlap with the main land drainages. This shore is the largest and is diverse enough to allow one or more extended nuclear families (or a band) to subsist year round within its confines.

A series of probable recurring, or semi-permanent village sites occur on this shore. One site (Athol) is located on East Lake, another (Wellington) on West Lake, and another (Smoke's Point) on Wellers Bay. The archaeological (field) proof of this is unfortunately lacking, and these sites are, as yet, unsubstantiated. Smoke's Point and Wellington are both known because of the extensive artifact collections, covering the Archaic and Woodland periods, reported in the A.A.R.O. of 1922 (Chadd Collection). The Athol site is known only by the extensive artifact collection collected by Bernard Parks from his farm in Athol. No field reconnaissance has been done for any of these three sites.

Environmentally, the Athol site appears to be well situated. It is located on the north shore of East Lake just within the outlet or notch through the sand bar. Even today wild rice is abundant here because the slowly circulating water and silty bottom create ideal conditions for it. As well, Athol is situated on large tracts of South Bay Clay Loam and Darlington Loam, both among the deepest richest soils of Prince Edward, ideal for such nut-bearing trees as: walnuts, butternuts, white oak, bur oak and shellbark hickory (all of which have deep taproots). Furthermore, Athol is handily located on a "peninsula" between East and West Lakes, allowing easy utilization of both bodies of water. In addition there is some outwash Brighton Sandy Loam close by, which may have supported Goosefoot, Pigweed, Raspberries or other species fond of loose textured soil (readily disturbed and sunny).
Other sites and unsubstantiated sites on East Lake also seem conveniently located to easily-gathered resources, especially aquatic plants. There is a high correlation between site location and the distribution of wild rice, cat-tail and bulrush; all considered efficient resources. Attersley and Cherry Valley, both substantiated Late Middle Woodland to Early Late Woodland sites, are also conveniently located to a large tract of Brighton Sandy Loam which resembles Vesey and Tioga Series a great deal (see Heidenreich 1971), and would presumably be an ideal agricultural soil.

The environmental attributes at Athol are duplicated to a degree at Wellington. The site is on the north shore, just east of the outlet through the sand banks; once again, because this created ideal conditions for wild rice. The soil too, in the vicinity of Wellington is the deepest in the area, although not as deep as at Athol. As well there is a great deal of glacial-fluvial and outwash soil, favourable for many types of gathered food resources. Wellington is situated between two creeks and within easy access of the marshes at the mouth of Bloomfield Creek and amongst the Sugar Islands in West Lake.

The third unsubstantiated recurring site is on Wellers Bay in the vicinity of Smoke's Point; this area, too, is on the north, east of the notch or outlet in the sand bar. (The Wellers Bay Sand Bar was once much more extensive and vegetated within living memory). The soil in the vicinity of Smoke's Point is quite deep in places, composed of Darlington Loam and Amelia'sburgh Loam. The former is well-suited for trees with large taproots. Marshy areas are quite handy, as are light soils (on Bald Head Island), and shallow water. Unfortunately there is no water-vegetation map available for Wellers Bay, but it is expected that wild rice was, or is, abundant in the area. Fishing was undoubtedly good at Wellers Bay or nearby Consecoon Marsh.

It is interesting to note that the diagnostic artifacts in the Chadd Collection (A.A.R.O. 1922) from Smoke's Point and Wellington, include ceramics and ceramic pipes as well as quantities of lithics, bird stones, gorgets and bayonets, which indicate that these northerly sites were occupied at least into Middle Woodland times, if not Late Woodland. This is puzzling at first because Athol appears to be
seemingly the better location, with better, deeper soil, two lakes, abundant marsh and beach. Could it be that after Archaic times increasing population, or changing cultural patterns, rendered Athol more isolated? Or was the hinterland of Athol (the peninsula between West and East Lakes and Athol, Picton - Glenora and Black River) too limited to continue sustaining the population? An other possibility is that the cooler, moister climate of Woodland times allowed the local vegetation to evolve into a forest cover with significantly less efficient food resources. Certainly any immediate hypotheses should be treated with caution until further palynological and archaeological studies have been done.

Another interesting observation regarding these three sites is that they are located at the junctions of north/south and east/west activity corridors, whereas most other sites are on east/west corridors. (Activity corridor in this sense is the direction of travel induced by the landscape. The major north/south corridors are the entire western shore of Lake Ontario and, to a lesser extent, the eastern shore. The east/west corridor is, of course, the Bay of Quinte followed by the streams and ridges between West and East Lakes and Picton Bay. The Conception Creek basin is another corridor, especially in its lower reaches. So are the streams of Hillier and the Black River to Milford). This location at the junction strengthens the hypothesis that these are recurring or semi-permanent village sites.

In West Lake and Hillier sub-drainage units, there are many other sites (mostly unsubstantiated to date), along the streams and swamps. Most notably are the Hillier sites on Hillier Creek, the Rose hall site on Hubbs Creek, the "Bloomfield sites" on Bloomfield Creek and the Huff and Trout Creek sites on Waring (or Trout) Creek.

THE EAST SHORE

The author discerns two foci of settlement on the east shore: South Bay and Waupoos (including the south shore of Smith's Bay).

South Bay has a sheltered body of water and considerable deep, fertile soil, (South Bay clay) on the south and east shores, and light textured outwash soil on the western side. South Bay could have supported many varieties of food plants, including those with large taproots and those which prefer loose, easily disturbed sandy soil. At the
Indeed, the entire north shore of North Marysburgh and Picton Bay and the Prince Edward site of the Long Reach are steep and unappealing while the area across the water (Adolphustown/ Hay Bay) appears attractive. It is there that the main settlement focus of the upper east shore may lie.

THE NORTH SHORE

The biggest know concentration of sites on the north shore is in the Muscote Bay area, especially Huff's Island where Paul Sweetman recorded the Barber (1, 2, 3) Nightingale and Black sites. As well two sites are known from the upper part of the Sawguin drainage: Redner (1 and 2), and Wallbridge. The marshy shallow water of Muscote Bay was the major environmental asset of Huff's Island because the soil there is predominantly imperfectly drained, although quite deep. The upper part of Sawguin is varied with fertile well-drained, deep soils and mucky swamp and marsh soils, offering many different food resources from nut-bearing trees to aquatic plants.

As with the east shore, the north is closely associated with the main land drainages to the north which have not been considered archaeologically or environmentally thus the north shore is not a distinct "region". Indeed, with the Moira and Trent rivers emptying into the Bay of Quinte across from the north shore, it would be surprising if these areas were not more attractive.

Green Point is reputed to have produced a quantity of archaeological specimens over the years and it too may have been a significant site. However, because the main-land drainages are not considered at present, it cannot be viewed in its proper perspective.

THE INTERIOR DRAINAGES

The dominant features of the interior is Consecon Creek and Black River and it is along these courses that most known sites lie, although the archaeological inventory is far from complete. For the Allisonville Swamp area most sites appear to be Late Woodland (Middleport stage) but this may be due to the incomplete inventory not the actual settlement pattern. In Consecon Lake there is one unsubstantiated Archaic site (Kirby) and at least one Archaic burial from Melville (Snack-Bar burial). Squire (pers. comm.) reports a village and several
encampments as Late Woodland but there is little if any real evidence to date. There no sites are reported from Big Swamp, except for an isolated find (Huiskamp Island) at the western end; once again this may be because little time has been spent surveying and interviewing in this area. It is significant that the Chadd Collection has no acquisitions from Sophiasburgh Township although every other township is represented to some degree.

A few sites are known from the Black River sub-drainage, mostly from the north area around Black Creek village. The Chadd Collection mentions a few items from the Milford area and the 1976 inventory revealed one unsubstantiated site (Miller and one isolated find (Bond) tributaries of Black River. Both probably relate to the Archaic period. Black River, just below Milford and beside South Bay (sub-drainage unit), is and was the most attractive area because of relatively deep soil and outwash parent formation which created good conditions for many efficient plants.
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head of the bay is shallow, marshy water, ideal for edible aquatic plants and fish. Three sites are known from the South Bay area: Old Minaker Farm and Duetta Mound relate to the Middle Woodland period, and Potash Point to the later Massassauga Late Woodland. The Hassenbach farm (unsubstantiated) located at the head of the bay in the marshy area is reported to be a good location for finding "arrowheads" and other stone tools; consequently this area may have a significant, (perhaps Archaic) site upon it.

"Waupoose" (composed of Waupoo and the south shore of Smith's Bay) is another settlement focus. It too is sheltered with an amenable local climate (today Prince Edward's best orchards are in this area). The Waupoo area has deep soil although much of it in the western peninsula is imperfectly drained. The Ameliasburgh and Darlington series in this vicinity were once noted for their black walnut trees, so presumably the area could have been productive in this sense prehistorically as well. Smith's Bay is known today as a warm body of water capable of supporting dense populations of plants and fish. The south shore is almost entirely sandy outwash loams, mainly Brighton. This loose textured, easily disturbed, sunny soil was quite likely ideal for efficient terrestrial herbaceous plants such as Goosefoot, Pigweed, and Raspberries. Another advantage to the Waupoose area is its high capability for deer (Class 2). There is some indirect evidence that prehistoric people exploited deer in the area, for the Waupoose site is (a small Late Woodland village or encampment) situated about one mile inland in close proximity to a steep escarpment. It is possible that deer aggregated here in the fall (perhaps to eat acorns and rut) and were driven into enclosures using the escarpment. This site was excavated by J.E. Pendergast (and plundered by dozens of others!) but there is no information that the faunal sample substantiates this theory. According to Pendergast there is also an Archaic site nearby, indicating that this was a popular location through time. If the Waupoose site was not chosen by the Late Woodland people because of its deer-hunting advantage then the only other reason for its use would be seclusion or passive defence, for the area is well concealed from the shore. However, the arable land in the area (by early agriculturalists' standards) is very limited and other convenient food producers, like marshes, are conspicuously absent for a year-round site location.

There are a number of other small unsubstantiated sites along the North Marysburgh peninsula as well as several disturbed burials. Although little is know archaeologically about these sites they are probably transient or short term camps.
Although there are many references to utilization by Indians of the inner bark of various trees, it is a very inefficient use of a resource and in almost all cases is gathered as survival or travelling food. The species described below are the fruit- and nut-bearing trees, which are much more elementary to the Indian diet.

APPENDIX I

FOOD - BEARING TREES

THEIR ATTRIBUTES, PREFERRED HABITATS, USES

AND

RELATIVE IMPORTANCE
FOOD - BEARING TREES

Although there are many reference to utilization by Indians of the inner bark of various trees it is a very inefficient use of a resource and in almost all cases is gathered as survival or travelling food. The species described below are the fruit-and nut-bearing trees, which are much more elementary to the Indian diet.

WALNUTS - JUGLANS

BUTTERNUT - JUGLANS CINERCA

HABITAT PREFERENCES - The butternut or "oil nut" tree has a deep taproot and prefers deep, rich, moist soils, especially on bottomlands or rich loams. It can, however, tolerate drier, rockier soils if the parent material is of limestone. (This may not have been possible in Prince Edward because of very shallow soils hiding the growth of the butternut's taproot except on alluvial or bottomlands, or on deeper loam by waterways). The butternut is very intolerant of shade which also perhaps explains its preference for sunny stream banks or the edges of swamps.

DENSITY OF GROWTH - The butternut is often found in groups but never in a poor stand.

FRUIT AND CROP - The nut is sweet and oily and is from 2 1/4 inches to 1 1/2 inches long, with the shell on. Statistics about the amount of fruit and the frequency of good crop years is not available at present.

SEASON OF AVAILABILITY - About the end of June the half-grown nuts can be cooked and eaten. The nut does not ripen and fall until October.

FOOD QUALITIES - The specific composition of butternut is not readily available. It is approximately 64% edible and readily digestible oil and 29% protein and 3.5% starch (Crocker and Barton 1957). At its half-grown stage the nut is high in vitamin C.

METHOD OF UTILIZING RESOURCE - Rogers in 1905 describes methods by which the pioneers made pickled nuts from the
immature fruit of butternuts and walnuts. This practice was evidently popular in Europe, however it is a safe assumption that native Americans at least ate the fruit at this stage. It is not clear how high the oil content of butternut is at this stage but it is high in vitamin C. The ripe fruit could be stored in its shell and cracked with a rod or more likely it was prepared in a fashion similar to hickories (see below). There are many accounts of the Indians of the eastern seaboard utilizing the oil of this species; for it can be rendered into a thick oil or even as solid as butter, and was esteemed as a food and an ointment. The oil evidently goes rancid quite rapidly unless kept in a cool place away from sunlight.

BLACK WALNUT - JUGLANS NIGRA

HABITAT PREFERENCE - The black walnut requires a deep, rich, well drained loam because although it has large laterals it also has a taproot. Thus its location in Prince Edward must be somewhat limited to the deeper, well drained soils. The early Quaker settlers of Prince Edward sought out the black walnut for the location of their settlements because they believed the tree denoted excellent soil. The tree is intolerant of shade and prefers hillsides where sunlight is plentiful. It can be found in small groves and prefers the company of beech, oak, cherry and hickory.

DENSITY OF GROWTH - There are no statistics at present.

WEIGHT OR MEASURE OF CROP - The crop of walnuts fails frequently but a good year can be expected every two-three years (F.S. Baker 1950). The nut with the shell on varies from 1 1/2 inches to 1 1/8 inches. There are no statistics as yet relating to the number of fruit per tree.

SEASON OF AVAILABILITY - The immature nut is edible around the end of June, but is not ripe until October.

FOOD QUALITIES - Complete compositions has not been determined but the protein is from 17% to 27%, the fat content is 65% and the starch content 16.5% (Crocker and Barton 1957), and .25% tannin.

METHOD OF UTILIZING RESOURCE - This is the same as for butternut and probably hickory.

THE HICKORIES - CARYA

The very name "hickory" is from an Indian work "Powcohickora" meaning "milk" (Rogers 1905).
This refers to the practice of boiling the nuts into a liquid.

**SHAGBARK HICKORY - Carya ovata**

**HABITAT PREFERENCE** - The hickory prefers rich, moist, well-drained loams and warm, fertile hillsides but it will tolerate rockier drier soil upon occasion. Hickories are intermediate in shade tolerance (Peattie 1950), and will reproduce under their own cover and can succeed other less tolerant species. They mix well with other hardwoods and are fond of sunlight, and are found commonly by streams and swamps.

**DENSITY OF GROWTH** - Exact figures are not possible at present, but they do grow fairly close together and would be fairly regularly distributed across a favourable habitat.

**WEIGHT OR MEASURE OF CROP** - Hickories seldom fail outright; they will always produce some seed with a bumper crop every three-five years. The nut measures approximately 3/4 inch to 1 1/2 inches.

**SEASON OF AVAILABILITY** - The nuts drop in October after the frost.

**FOOD QUALITIES** - The nuts fall separately from the husks after the first frost. The hickory nut is at least 47% oil and approximately 12% protein and 8% carbohydrate, tannin .47%.

**METHOD OF UTILIZING RESOURCE** - William Bartram in his *Travels in North America*, written early in the eighteenth century described in some detail the method by which the Creek Indians utilized hickory nuts: "...They pound them to pieces, shells and all, and cast them in boiling water which after passing through five strainers preserves the most oily part of the liquid...it is as sweet and fresh as cream and is an important ingredient in their cooking". Other accounts cited by Fernald and Kinsey 1943 indicate that the practice was widespread in the eastern woodlands and that they were able by this process to separate the nuts into shells, liquid, meat and oil. The liquid was utilized immediately, most likely in venison soup and the meat was shaped into cakes and dried for winter use. In the winter the dried meat could be added to soup or ground into flour for bread. The oil too was kept for a short time although it tends to go rancid quite swiftly.

**THE SHELLBARK HICKORY OR "KING NUT" - Carya laciniosa**

**HABITAT PREFERENCE** - This species has a taproot and is restricted to bottom lands and low fertile hillsides.
DENSITY OF GROWTH - No figures are known but it is presumed that it is not great.

WEIGHT OR MEASURE OF CROP - Like shagbarks, there is some seed every year and a good crop more irregularly. The nuts of this species are larger than other hickories (1 inch to 1½ inches) and have a very thin shell. They too fall separately from their husk and are especially sweet and oily. Furthermore, shellbarks probably produce an abundance of nuts because, being bottom land and waterside-loving species, they have more opportunity to grow as isolated trees in man-made clearings along the shore, for isolated trees are notoriously heavy seeders (Baker 1950).

SEASON OF AVAILABILITY - October.

FOOD QUALITIES - Similar composition as shagbark but with larger kernels and thinner shells, making preparation easier. The nuts fall already separated from the husk. The tree is a reliable and usually heavy seeder.

PIGNUT HICKORY - *Carya glabra*

HABITAT PREFERENCE - The pignut is an upland species with a strong preference for dry, morainic soil along ridges and hillsides.

DENSITY OF GROWTH - No statistics available, but it probably is fairly evenly disturbed in association with red oaks and pines etc.

WEIGHT OR MEASURE OF CROP - Seed crops of pignut hickory are essentially annual with small variation.

SEASON OF AVAILABILITY - Early autumn-mid September.

FOOD QUALITIES - The nut is smaller than the shagbark and has a thicker shell and a small, bitter or sweet kernel. The nut is edible, but probably would require some preparation. The nut falls early but is not separated from the husk.

METHOD OF UTILIZING RESOURCE - There are no known descriptions, but the nuts probably are crushed like other nuts, shell and all, and leached in ashes and dried before they become palatable.
BEECH - *FAGUS GRANDIFOLIA*

HABITAT PREFERENCE - The roots of the beech tree are shallow and it is able to live on poor soil and rocky soil. It loves rich limestone parent material overlaid by deep loam. It is also common in bottom lands and moist, well - drained slopes and ridges.

DENSITY OF GROWTH - No figures are present but the beech undoubtedly occurs regularly and in good locations.

WEIGHT OR MEASURE OF CROP - Beechnuts fall frequently with three - five years between good crops. The nuts are ¼ inch to ¾ inch long at maturity. There are 1300 to 2300 nuts to the pound. (Harlowe and Harran).

SEASON OF AVAILABILITY - October. The beechnuts evidently drop all on the same night, when there is the first "black" or killing frost.

FOOD QUALITIES - as a food the beechnut is excellent except that it comes irregularly and it does require some preparation. The nut falls separately from the husk however. Beechnuts are 15% protein, 30% oil and 26% carbohydrates. The beechnut was a favourite food of the passenger pigeon who "migrated" in great numbers each year to those beech trees with a good crop. The pigeons became extinct with the great beech forests.

METHOD OF UTILIZING RESOURCE - The author was not able to find any accounts of native use of this nut; however the early settlers in the New England states ate it and their method is described: The sky was watched closely near nutting time to determine when the killing frost would come. On that night blankets, sheets and coats were spread out under favourite old beeches (undoubtedly isolated trees on good soil) and the nuts would fall into the containers. The nuts are then roasted quickly to split the shells, then they are chaffed with the hands to separate seed from husk; finally these were winnowed in sheets, tossing the nuts and husks into the wind where they separated.

The french in Europe made a fine cooking oil from beechnuts which was esteemed as olive oil, even without refining although the meat itself was more often fed to pigs than to humans (at least in later times, for most European people have eaten beechnuts sometimes in their history).
AMERICAN CHESTNUT - CASTANEA DENTATA

HABITAT PREFERENCE - The chestnut will grow well on a variety of soils and is usually found in association with other hardwoods. It favours deep, well-drained soil but it will tolerate rocky hillsides. The chestnut does not like poorly drained soil or too much limestone.

DENSITY OF GROWTH - There is very little scientific information about the chestnut as it was stricken with a disease sometime ago and has virtually vanished. It was however an extremely common tree; often almost the dominant species (i.e. oak - chestnut forest type). It has been stated that over 50% of the standing timber in some areas was chestnut.

WEIGHT OR MEASURE OF CROP - Like the hickory, the chestnut produces some seed annually with a good crop every three - five years. The nuts are about 1/2 inch long and there are about 130 nuts to the pound (Harlowe and Harrar).

SEASON OF AVAILABILITY - October to November after the frosts.

FOOD QUALITIES - The nut falls free of its burr after the frost. The nuts are large and the shell is thin. The meat is sweet and edible with very little preparation. The trees are moderate but dependable seeders. The chestnut is 11% protein and 7% oil. Carbohydrates are probably quite high.

METHOD OF UTILIZING RESOURCE - No accounts of Indian use of this nut are presently known, although it is certain that such a sweet and easily procured resource was being used. There are accounts of utilization by pioneers however and they indicate that roasting was the common method of preparation. Because of their low oil content and high carbohydrates, chestnuts may have lent themselves well to flour and hence to bread - making.

CHINQUAPIN - CASTANIA PAMILA

HABITAT PREFERENCE - This species is not found today in Ontario but it is fairly cold-hardy and has been found as far north as Pennsylvania, New Jersey and Boston. Consequently it may once have flourished in
Ontario in warmer periods. (According to J. Macoun 1894, the forests of southern and southwestern Ontario resemble those of Pennsylvania a great deal.) It is not certain whether palynology or any other science will be able to determine if this tree was a component of the Atlantic - Sub - Boreal forest of Prince Edward.

The chinquapin is a small tree growing in thickets on hillsides and bare ridges and along the margins of swamps. According to Peattie 1950, it likes rich soil with a high water table.

**DENSITY OF GROWTH** - No statistics are available but the growth is obviously dense in a thicket. How the thickets are disturbed across the landscape is not known however.

**WEIGHT OR MEASURE OF CROP** - The crop matures biannually, like red oak, and the nut is from ½ inch to 1 inch long. No statistics are presently available.

**SEASON OF AVAILABILITY** - Every second autumn, probably between late September and early November.

**FOOD QUALITIES** - The physical composition is not available but it may be similar to American chestnut. The kernel is however reputed to be sweeter and larger than regular chestnut. The nut falls free of its husk which save some effort in preparation. The shell is relatively thin and the tree is probably a relatively prolific seeder. Because it is a small tree, growing in thickets, it will have a high aggregation size.

**METHOD OF UTILIZING RESOURCE** - Probably similar to American chestnut.

**THE OAKS** - **QUERCUS ALBA**

**THE WHITE OAK** - **QUERCUS ALBA**

**HABITAT PREFERENCE** - The white oak grows on a variety of soils from sandy or gravelly ridges to moist, rich bottom lands. It has both a deep taproot and broad laterals. Its branches can often spread 50 feet outwards from the trunk, even in forest growth. The oak is of intermediate tolerance and does not persist well with
aggregative hardwoods like beech and maple. It is usually found in association with hickories, chestnuts or pines.

**DENSITY OF GROWTH** - White oaks are rarely found in stands and sun-loving as they are they appreciate a lot of room. Oak forests are known to be open and free of most undergrowth. The oaks are regularly and widely distributed across favourable habitats.

**WEIGHT OR MEASURE OF CROP** - White oaks are light and irregular seeders. Their crops fail regularly but a good one can be expected every two - three years. The acorns measure about 3/4 inch to 1 1/2 inches long and average at 150 nuts to the pound.

**SEASON OF AVAILABILITY** - October.

**FOOD QUALITY** - The nuts are relatively thin-shelled and the kernel is large and fairly sweet. Available protein in the white oak is 6%, oil 3.5% and carbohydrates 43%. Tannin is 5.5% (which is quite bitter compared to .25% for walnuts).

**METHOD OF UTILIZING RESOURCES** - J. E. Rogers (1905) cites an early work by Mark Catesby circa 1750 who noted that the Indians of the eastern estates made soup from acorns and extracted a fine oil which they used on their bodies. The use of white oak acorns was quite widespread and there are other accounts which describe how the nuts were roasted, hulled and mixed with ashes and water to leach out the tannin. The result could than be dried and milled into flour to make breadstuffs. According to Fernald and Kinsey (1943) the acorns were usually used for bread-making.

**RED OAK** - **QUERCUS BOREALIS**

**HABITAT PREFERENCE** - The name "red oak" in this study refers to a group of similar species, namely scrub oak, black oak, crimson oak and swamp oak. White oak refers to different species but as they are usually edible they are dealt with separately below.

The red oaks have both deep and spreading roots and are well adapted to a variety of soils. They do very well on rich soil. They are usually found in groups,
although rarely in pure stands. They are often in association with red and white pines.

**DENSITY OF GROWTH** - No statistics are available at present. Although density is not likely to be high they are probably regularly distributed across favourable habitats.

**WEIGHT OR MEASURE OF CROP** - The acorn of red oaks are biannual and are \( \frac{1}{2} \) inch to 1 \( \frac{1}{2} \) inches long. The trees are known to be heavy seeders.

**SEASON OF AVAILABILITY** - October.

**FOOD VALUE** - The red acorn is an extremely bitter nut with a tannin content of 9.5%; it therefore requires a complicated leaching process. Protein is about 3%, similar to white acorns and carbohydrates are lower, about 25%. The red acorn is however very rich in oil, varying from 11% (Crocker and Barton 1957) to 23% (J. E. Rogers 1905).

**METHOD OF UTILIZING RESOURCE** - The red oak acorn requires a complicated and prolonged process of leaching before the meat is edible. This process is probably similar to that described above for white oaks, except that it would be a stronger solution, or would require repeated treatments. The meat was probably used for flour to make bread. The red acorn was probably more valuable and esteemed as an oil-producer; indeed this may sometimes have been the sole reason for gathering them.

**THE BUR OAK** - *QUERCUS MACROCARPA*

**HABITAT PREFERENCE** - The bur oak is a "white" oak with a comparatively short taproot. It prefers rich, well-drained deep soil, especially bottom land and low hillsides. It is often associated with white elm and maples.

**DENSITY OF GROWTH** - No exact figures are available but the species can occur in widely spaced groves.
WEIGHT OR MEASURE OF CROP - No statistics on crop
frequency are available but the nut itself is large, com-
monly exceeding 2 inches in length. Peattie (1950) cites
accounts of bur oak forests being fired, presumably for
ease of deer hunting.

SEASON OF AVAILABILITY - As with other acorns,
autumn.

FOOD VALUE - Statistics relating to the physical
composition are not available but are probably similar to
white oak. The kernel is reported to be quite sweet.
(Dept. of Forestry Bul. 61).

METHOD OF UTILIZING OF RESOURCE - Undoubtedly this
would be similar to other "white" oaks - a comparatively
complicated preparation, used mainly for breadstuffs and
oil.

CHESTNUT - OAK - QUERCUS PRINUS

HABITAT PREFERENCE - The chestnut - oak is a
small tree, only found today in southern Ontario, (Dept.
of Forestry Bul. 61) and is often associated with chin-
capin - oak (Quercus Meuhlenbergii). It is usually found
on dry, rocky, sterile limestone soils. It loves sun -
light and favours ridges or the sides of streams, as well as
steep hillsides and sunny ravine slopes. The chestnut -
oak likes elbow - room and often grows in nearly pure
stands; although will mix with other hardwoods especially
chestnuts, on richer soils.

DENSITY OF GROWTH - As stated above the chestnut -
oak enjoys pure stands but it is still fairly widely
distributed.

WEIGHT OR MEASURE OF CROP - Statistics about
crop frequency are not available but the acorns are
supposed to be quite large, 1 to 1½ inches, or 75 nuts
to the pound.

SEASON OF AVAILABILITY - October.

FOOD QUALITIES - Statistics about the physical
composition of the meat are not available. They are
however "sweet:" (low in tannin) and have been equalled
to chestnuts as a food (Peattie 1950). The pure stands and small stature of the trees must have been an asset to the gatherers.

METHOD OF UTILIZING RESOURCE - See chestnut - oak above.

CANADA PLUM - PRUNUS NIGRA AND WILD RICE - PRUNUS AMERICANA

HABITAT PREFERENCE - The plums are small trees which prefer moist well-drained soil from limestone parent material. They are sun-lovers and grow along the borders of streams and swamps and sunny hillsides.

DENSITY OF GROWTH - No exact figures are available, however plums favour in thickets.

WEIGHT OR MEASURE OF CROP - No statistics.

SEASON OF AVAILABILITY - August to October.

FOOD QUALITIES - The fruit is sweet and sour, juicy and fleshy. It is easier to gather due to the low stature of the trees and the high aggregation size (thicket growth). The fruit dries well and is easily prepared.

METHOD OF UTILIZING RESOURCE - The fruit was of course eaten fresh, out of hand, but both the fresh and dried fruit were used as a stew or as a flavouring for soup. (Fernald and Kinsey 1943).

HAWTHORNS - CRATAEGUS

HABITAT PREFERENCE - The hawthorn has dozens of species and grows on a variety of soils. It likes sunlight however and prefers a clearing on the borders of streams and swamps.

DENSITY OF GROWTH - Exact figures are lacking. The hawthorn sometimes grows in thickets although it is not widely distributed.
APPENDIX II

CHARACTERISTICS OF EDIBLE AQUATIC PLANTS

Cattail or Bulrush

This plant favors alluvial mud flats and flood plains. It has a high growth density. The seed tubers are available from October to November and may be used or baked for use as a starchy vegetable. The dried tubers can be ground and used as flour. The tubers may also be dried and stored easily.

Pondweed

This plant favors the margins of muddy shallow waters. Although common, it has a fairly low growth density. The flowering stems are collected in August to September and are useable as a vegetable.

But - used

This plant is found along the edges of muddy shallow waters and commonly grows in colonies. The tubers, due in October to November, grow quite far apart and are often in deeper marginal water. The tubers are boiled and baked as a starchy vegetable. They may be farinaceous and may be storable if dried.

Cat - tail

Cat - tails occur around the margins of quiet waters everywhere. They are widely distributed and grow in dense colonies. The stem can be eaten from spring to fall, the shoots in May, the flower in June - July and the pollen in August. The roots are available in October and November and are farinaceous, the flour useable in bread and soup. The shoots, stem and flower can be boiled as a starchy vegetable and the pollen can be used as flour for soup and bread. The root can be dried and stored.
WEIGHT OR MEASURE OF CROP - No statistics available.

SEASON OF AVAILABILITY - From September to winter depending upon species. Some species retain their fruit into the winter.

FOOD QUALITIES - Also varies from species to species. All are edible but the amount of flesh and juice varies. The berries are easy to gather and dry well.

METHOD OF UTILIZING RESOURCE - There are no available accounts of use by native people, although it is highly probable especially because it stores well and can be available late in the year. Undoubtedly it was used in soup predominantly.
Arrowhead

This plant grows along the margins of shallow muddy waters. It is fairly widely distributed and grows in small colonies. The tubers are available from August to October and can be boiled and baked as a starchy potato-like vegetable or it can be dried and ground into flour for use in bread or soup. When dried it is easily stored.

Mud Plantain

Mud Plantain grows along the margins of muddy shallow waters. No information is available regarding distribution and growth density. The roots are available from October to November and are dried and then ground into flour for use in bread and stew. The roots are storable when dried.

Manna Grass

This plant is found in ponds or inundated areas. Distribution and density characteristics are not available. The seeds are available from July to August and are ground into flour for use in bread and soup. The dried seeds are probably storable.

Wild Rice

Wild Rice are found in shallow muddy waters with slowly circulating current. It was once widely distributed and grows in dense colonies. The seeds are gathered in August to September and are packed, and winnowed and then used in soup or ground into flour for bread. The parched grain is readily stored.

Bulrush

Bulrush grow along pond margins or in marshes and swamps. They are widely distributed and grow densely. The root stock is available from October to November. They can be peeled, dried and ground into flour for use in soups, and bread, and they are a readily stored when dried.
Yellow Waterlily

These plants grow in the deeper margins of muddy quiet waters. They are widely distributed and often grow in dense colonies. The roots are collected from September to October and can be boiled or roasted as starchy vegetables. The seeds can be collected in August or September and when dried are useable in stews or soups. They can also be popped. The seeds are readily stored and the root may be storable too, if dried.

Pondweed

Pondweed grows in muddy shallow waters and is often widely distributed and grows densely. The tubers are available from October to November but are small, widely distributed and remote from the parent plant. The tubers can be boiled or roasted as a starchy vegetable and are probably farinaceous as well. They may be stored if dried.
This sun loving plant favors rich soils, often along the shore of streams and ponds. The tubers can be gathered in November and roasted or boiled as starchy potato-like vegetables. In the dry state they may be storable.

**APPENDIX III**

**CHARACTERISTICS OF EDIBLE TERRESTRIAL PLANTS**

Dock grows in a wide variety of soil. The young leaves are used as a green vegetable (boiled) and the seeds, gathered from August to September can be ground into flour for bread and soup. The dry seeds are readily stored.

Rosefoot and Pig Wead

These two unrelated species have many similarities. They both prefer rich disturbed or burnt over soil where sunlight is abundant. The seeds can be collected from October to November because of their ability to remain on the plant till late fall or early winter. The seeds are farinaceous and used in bread and soup. The young shoots and leaves of these plants provide a succulent pot herb, and the seeds of both species are readily stored.

Service berries
CHARACTERISTICS OF EDIBLE TERRESTRIAL PLANTS

Jerusalem Artichoke

This sun loving plant favors rich soils, often along the shore of streams and ponds. The tubers can be gathered in November and roasted or boiled as starchy potato-like vegetables. In the dry state they may be storable.

Evening Primrose

This species prefers dry gravelly open soil where sunlight is abundant. The root stock of first year plants can be gathered in November and boiled twice or roasted and is used as a starchy vegetable. In May and June the young stem and leaves can be boiled and eaten as a green vegetable. The dried root stock may be storable.

Dock

Dock grows in a wide variety of soil. The young leaves are used as a green vegetables (boiled) and the seeds, gathered from August to September can be ground into flour for bread and soup. The dry seeds are readily stored.

Goosefoot and Pig Weed

These two unrelated species have many similarities. They both prefer rich disturbed or burnt over soil where sunlight is abundant. The seeds can be collected from October to November because of their ability to remain on the plant until late fall or early winter. The seeds are farinaceous and used in bread and soup. The young shoots and leaves of these plants provide a succulent pot herb, and the seeds of both species are readily stored.

Service Berries

These plants grow on a variety of soils but are often found on rocky or gravelly soils. Their abundant fruit ripens in July and August. Besides being eaten fresh the fruit can be pasted and sundried and reconstituted later for flavouring puddings and soups.
Strawberry

Strawberries are sun-loving plants and prefer loose acidic soil. The fruit is abundant in June and July. Although eaten fresh from the hand or in fruit soup, it can be stored by forming a paste of mashed berries and allowing this to dry in the sun until a pliable "leather", is obtained. This can be reconstituted later for pudding or flavoring.

Grapes

These sun-loving vines favor clearings and the shores of lakes and streams and adapt to a variety of soils. The fruit is ripe in September and October and can be treated and used in the manner of strawberries and Service Berries.

BlackBerry

There are many varieties of blackberries and they favor all types of environments from swamps to uplands and shade to sun. They are available from July to September, often abundantly and can be prepared and stored in the manner of strawberries etc.

Milkweed

This plant prefers sunny loose, sandy or disturbed soil and is widespread and abundant in favorable situations. The young shoots in June and the flowers in July provide a succulent pot herb as do the small seed pods in July and August. Two boilings are usually necessary.

Elderberry

The Elderberry is widespread and often on moist fertile soil along the shores of streams and lakes. The fruit grows in dense clusters and is ripe from July to August. These are dried and ground into flour for use in soups and stews. In this form, or as the dried fruit, it is readily stored.
Chokecherry

This small tree is sun-loving and well adapted to many soil conditions although it is common on loose sandy or gravelly soil. The bitter cherries are gathered in August and September. They are prepared by drying and grinding (stone and all) into flour which is used in soup, pudding or bread. The flour and dried fruit are easily stored.
White Fish

The white fish inhabits the deep cold waters at about 150 feet where it feeds on plankton and snails. Another variety, the Round White Fish inhabits shoal waters. White fish move in schools and may be found in shallow water after spawning or early in the spring when the coldest water conditions exist. They spawn in November on shoals or rocky gravelly bottoms. They are lake spawners although the Round White fish prefers stream mouths. Both varieties are night spawners, and are found at their greatest density at that time. They can attain a weight of up to 20 lbs. but the average weight, even in prehistoric times, would have been considerably lower, especially for Round White fish.

Suckers and Mullet

These two closely related species are scavengers inhabiting the clean shallow water of lakes and streams everywhere. The mullet, however, is a larger fish and prefers the deeper water of lakes. In April or May both species spawn together during the day in gravelly ripples of streams and rivers. They also spawn off gravelly beaches. Their main food is the small plants and animals found on the bottom. Suckers and Mullers are wide spread and common but their density is greatest at spawning time and they are easily captured at that time. Suckers may average from 1 to 2 lbs. while Mullets often weigh as much as 5 lbs.

Pike, Muskelonge and Chain Pickeral

These closely related fish inhabit weedy shallow bays and shoals where they feed on fish, frogs, crayfish and insects. All species are active in very shallow waters soon after the ice melts. They spawn at this time of the year, the Muskelonge in weedy bays and the Pike and Pickeral in freshets, streams or ditches. In the summer months the Muskelonge lie idle in somewhat deeper waters but the Pike and Pickeral remain in the shallow bays and shoals. All species are active in shoal waters during the fall. Although these fish are widespread and common they are seldom densely aggregated, even during spawning so that although they are a consistent resource their numbers prevent them from being very efficient.
Fresh Water Drum

These fish prefer shallow water with muddy or sandy bottoms and they feed upon the mullosk and crayfish found there. They spawn in May or June off sandy, gravelly, shoals and it is then that their density is greatest. Fresh water drum weighing 20 lbs. are common and they may attain a weight of 50 or 60 lbs. when full grown.

Smelts

Only Lake Ontario was inhabited by smelts in prehistoric and early historic times. They prefer the deep cold clear water at a depth of 60 - 120 feet where they feed upon minute crustacea and plants. In March they move into the shoal water in great numbers before ascending streams and rivers after the ice breaks up, they are night spawners and are also known to spawn off sandy beaches of lakes in lieu of suitable streams. Their aggregation or density is extremely high at this time and it is in this season that they could be most easily captured. Smelts are very small and average about 2 - 3 ozs. in weight.

Shallow Water Circoe

These small fish travel in large schools and frequent cool clear shallow waters except in the summer when they move to greater expanses. They spawn in November or December on sandy gravelly beaches in about 8 - 10 feet of water soon after the ice begins to form. At this time their numbers, always dense, are at their greatest. The Fresh Water Circoe average ½ lbs. in weight.

Bullheads

There are many species of Bullheads but their characteristics are similar. They are omniverous bottom dwellers and prefer muddy shallow water where they are found in loose schools or groups. They spawn from April to June in warm shallow water and it is at this time that their density is greatest and they are most easily obtained. Bullheads average about 1 ½ lbs. although some varieties are considerably smaller.
Bowfin and Gars

These two ancient species are not related yet they share many characteristics. Their preferred habitat is warm weedy sluggish shallow muddy waters. They spawn from May to July in shallow weedy water. The Gars spawn in schools during the day and the Bowfins in small groups or pairs during the night. Although these species are widely distributed and common their density is usually low except for Gars during the spawn. Gars and Bowfins feed upon small fish, frogs, insects and crustacea. Both species average 2 - 3 lbs. in weight.

Yellow Perch

Yellow Perch inhabit a variety of waters but show a slight preference for open water with moderate weeds where they feed upon small fish, insects and crustacea. Perch spawn in April and May in the sheltered bays and shoals of lakes in 5 to 10 feet of water. They are night spawners and although they travel in loose schools their density is greatest at that time. Perch average ½ lbs. in weight.

White Bass

White Bass are lake dwellers and prefer cold clear moderately deep expanses of water. They travel in large schools near the surface where they feed on Shad and Shiners. White Bass will enter tributary or tail waters at certain times during the year, usually in the fall when water temperatures are lower. They spawn in lakes in late May or early June, during the day, in 3 - 6 feet of water over sand, gravel and rock bottoms. Their density is always high due to their habit of schooling, but their aggregation is certainly highest during the spawn. White Bass average 2 - 3 lbs. in weight.

Walleye

Walleye are common inhabitants of the Great Lakes and tributary systems and prefer shallow water over hard rock and gravel bottoms, except in the summer when deeper colder waters are sought. They spawn in April soon after the ice breaks up. They are night spawners and choose sandy gravelly bottoms of both tributary waters and lakes. Often suckers and Mullet and Walleye spawn on the same bottom, the former during the day the latter at night. Although common and widely distributed in shallow water throughout the year they are densely aggregated during the spawn and are most easily obtained then. Walleyes feed on a variety of small fish.
and crustaceae and may attain in a weight of 3 lbs or more.

**Gizzard Shad**

These fish inhabit clear to muddy, mud-bottomed shallows where they feed exclusively upon plants. Because they are found in schools their density is always high but periods of higher aggregation occur in the fall when they assemble off shoals and river mouths and in the spring when they spawn. They average 3/4 lbs in weight.

**Mooneyes**

Mooneyes prefer shallow expansive water with moderate weeds where they travel in large schools and feed upon minute plants and animals. They spawn in great numbers in April in the shallow water of rivers and streams. They may attain 3/4 lb in weight.

**Alewife**

The Alewife inhabits open waters and travel in large schools feeding upon insects and minute crustaceae. They do not inhabit the shoals until late in May or June when they spawn in shallow sandy bottomed water of lakes or ascend small streams to small ponds. Their numbers are very dense at this time and they are easily caught in dip nets. They may weigh about 3/4 lbs.

**Sun fish**

Sun fish includes many varieties of small fish who travel in loose groups in clean shallow water with sandy or mud bottoms and copious weed growth. They feed upon a wide variety of plant and animal life. At the end of June and in July they build nests in shallow sandy water. After spawning they remain localized in the nesting area to protect the eggs and young. Although they are widely distributed and very common their spawning aggregation is less than other species their presenting a low work/reward ratio. However they are a constant resource and are most highly aggregated at a time when few other species are. Sun fish average ¼ to ½ lb.
Bass

Small and Large - Mouth Bass dwell in lakes and rivers. The Small - Mouth prefers clear cool water with a rocky bottom while the Large - Mouth favors warm shallow weedy water. They are widely distributed and are isolated forages or travel in small groups. In their spawning habits and value as a food resource Bass resemble Scurfish although a month earlier. They feed upon small fish, frogs, insects and crustaceae and although weights of 15 lbs. or more can be attained an average may be closer to 2 - 4 lbs.
CHARACTERISTICS OF SOME FRESHWATER FISHES

Sturgeon

Sturgeon inhabit the shoal waters of the Great Lakes and large rivers although summer temperatures may depel them briefly in deeper water. They spawn in May or June on stony gravel below rapids at a depth of 10 feet of during the day. They also are known to spawn off gravelly beaches in the Great Lakes. Although sturgeon were widespread and common they tend to travel as isolated fish or loose groups as they search for the small bottom-dwelling plants and animals upon which they feed. There are many different varieties of sturgeon and their size and habitat vary; however, the Lake Sturgeon of Lake Ontario as the largest and in the part fish exceeding 500 lbs. would be common although an average weight would be considerably lower. Of course the average weight of a sturgeon taken prehistorically by spear, gorget or net was certainly smaller than that perhaps in the range of 15 to 50 lbs.

Salmon

Salmon used to live and spawn in the waters of lake Ontario. They inhabited the deeper cold clear water where they fed upon chub and alewife, although they may enter stream mouths at any time of year if temperature and flow are suitable. They spawn in rivers in the autumn from November to early December, when the water is between $54^\circ$ to $68^\circ$. They are night-time spawners. Their density during the spawning season was phenomenal and they were taken in large numbers with spears and baskets.

Lake Trout

Like salmon, trout prefer the deep cold clear water; although they frequent the shoal waters in early spring when the water temperature is low. They are lake spawners and prefer rocky reefs and shoals at a depth of 8 to 10 feet and a water temperature of $54^\circ$. They are also night-time spawners and the season is mid-October to mid-November. Because their density is only great at spawning time and because they are so inaccessible even at that time they are an inefficient resource in comparison with salmon.
APPENDIX V

CHARACTERISTICS OF NUT TREES

This tree has a taproot and prefers deep well-drained soils along shorelines although it is also fond of drier conditions and limestone derived soils. It is a medium sized tree which grows in small groups, never in groves. The nut measures from 3 cm to 6 cm long, in the shell. It is 44% oil, 29% protein and 31% carbohydrate. It can be peeled and eaten early in its development when it also contains vitamin C. The mature nut is ground shell and boiled and separated. The flesh is used for soup or in an immature fruit and in October as a mature nut.

Black Hickory

This tree prefers rich moist, well-drained soil along shorelines and low sunny hillsides. It can grow densely and is widely distributed. The crop is not annually and a bumper crop occurs every 3-5 years. The nut measures 2 cm to 4 cm long in the shell and is 41%, 12% protein, 8% carbohydrate and 47% tannin. It is prepared by grinding, shell and flesh, boiling and separating and is used for soup, bread and oil. It is available in October.
CHARACTERISTICS OF NUT TREES

Butternut

This tree has a taproot and prefers deep well drained soil along shorelines although it is also fond of drier conditions and limestone derived soils. It is a medium sized tree which grows in small groups, never in groves. The fruit measures from 3 cm to 6 cm long, in the shell. It is 64% oil, 29% protein and 3% carbohydrate. It can be boiled and eaten early in its development when it also contains vitamin C. The mature nut is ground shell and all, boiled and separated. The flesh is used for soup or bread, the oil for food and ointment. It is available in June as an immature fruit and in October as a mature nut.

Walnut

This tree has a taproot and prefers deep well drained soil on low sunny hillsides. It grows in small isolated groves. The fruit crop fails frequently but a bumper crop can be expected every 2 - 3 years. The nut measures 3 - 4 cms long in the shell and is about 65% oil, 27% protein, 16% carbohydrate and 4% tannin. It is prepared by grinding (shell and flesh), boiling and separating and is used in soup or bread and for oil. It is available in October.

Shaybark Hickory

This tree prefers rich moist, well - drained soil along shorelines and low sunny hillsides. It can grow quite densely and is widely distributed. The crop is present annually and a bumper crop occurs every 3 - 5 years. The nut measures 2 cm to 4 cms long in the shell and is 47% oil, 12% protein, 8% carbohydrate and 4.7% tannin. It is prepared by grinding, shell and flesh, boiling and separating and is used for soup, bread and oil. It is available in October.

Shellnut Hickory

This tree has a taproot and prefers bottom lands and low fertile hillsides. It grows as isolated trees or in small groups. There is some crop annually and a bumper crop every 3 - 5 years. The nut is 2.5 cms to 4 cms long in the shell.
The shell is thin and the nut falls from the tree free of its husk. Its composition is similar to the Shagbark Hickory as is its method of preparation and are. It is also available in October.

**Pignut Hickory**

This is an upland species, preferring dry morainal hills and ridges. It grows with a high aggregation throughout suitable environments. The crop is annual with little fluctuation in quality. The nut measures 1 to 1.5 cms long in the shell and is thick shelled, small fleshed and butter. Its method of preparation and utilization are similar to Shagbark Hickory although the flesh may have to be leached to remove the tannin. It is available as early as mid-September.

**American Beech**

This tree grows on a variety of soils has a high aggregation over large areas. The fruit crop fails frequently although a bumper crop occurs every 3 - 5 years. They are 30% oil, 15% protein, and 26% carbohydrate. They are prepared by roasting, hulling and winnowing or grinding, boiling and separating. The meat is used in soup or bread and the oil for food and ointment. The crop is due in October and falls entirely on the night of the first "black frost".

**American Chestnut**

This extinct species grew on a variety of soils but was not favourable to soil derived from limestone parent material. It had a high aggregation over wide areas and produced some fruit annually with a bumper crop every 3 - 5 years. The nut was about 2 cms in length in the shell and was about 7% oil, 11% protein, and high in carbohydrates. It was prepared by roasting, hulling and winnowing or by grinding, shelling flesh, boiling and separating. It was used for bread, soup, and oil and was available from October to November.
Chinquapin Chestnut

This small tree grows on hillsides and bare ridges and the margins of swamps but it adapts to a variety of soils. It grows on thickets but not over a wide area. The fruit is from 1 cm to 3 cms long in the shell. No statistics are available for crop frequency or nut composition but the flesh is sweet and similar to chestnuts. It seeds bi-annually, and its preparation, use and season of availability are probably similar to chestnut as well.

White Oak

This species grows on a variety of soils but prefers deep, rich and well drained. It has a taproot and also likes sunlight. It never grows in pure stands but is common over wide areas. The crop fails frequently but a bumper crop can be expected every 2 - 3 years. The nut is 2 to 4 cms long in the shell and is 3.5% oil, 6% protein, 43% carbohydrate and 5.5% tannin. It is prepared by roasting, hulling, leaching, drying and grinding and is used in soup and bread and for oil. It is available in October.

Red Oak

This tree also grows in a variety of soils but it is common in sandy and rocky situations. It can grow in small groups and has a fairly high distribution over wide areas. It seeds biannually and the crop is usually abundant. The nut measures 3 to 4 cms long in the shell and is 17% oil, 3% protein, 25% carbohydrate and 9.5% tannin. The method of preparation is similar to white oak but it probably requires even more leaching. Its uses are also similar to White Oak but with more importance on oil. It is available in October.

Bur Oak

This tree prefers deep, rich, well-drained soils in bottomlands on low fertile hillsides. It can grow in widely spaced groves but is not common over wide areas. The crop measure, nut composition, preparation and use are probably similar to White Oak. It is available in October.
Chestnut Oak

This sun-loving tree prefers rocky, sterile limestone soils, especially along the borders of streams and swamps. It has a low distribution over wide areas but occurs in thicket growth. The nut is 3 - 4 cms long in the shell. There is no information for crop measure and composition. It is probably prepared similarly to White Oak. It is available in October.

Chincapin Oak

This oak is also sun-loving and fond of rocky, sterile limestone soils. Statistics for density, aggregation, crop measure, nut composition, preparation and utilization are not available but are probably similar to Chestnut Oak and White Oak. The nut is available in October.
### Some Physical Attributes of Prince Edward

By Physiographic Units

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<th>Swamp (sq.mi.)</th>
<th>Well Drained (sq.mi.)</th>
<th>Poorly Drained (sq.mi.)</th>
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APPENDIX VI

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<td>- slopes less than $5^\circ$</td>
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<tr>
<td>North Shore: level terrain with</td>
<td>Mostly imperfect - some well - drained</td>
<td>slightly acidic to alkaline</td>
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<tr>
<td>some rolling and undulating - slopes $5^\circ$</td>
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<td>$10^\circ$</td>
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<tr>
<td>Interior: level with some undulating</td>
<td>Mostly well - drained</td>
<td>Mostly alkaline</td>
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<td>- slopes less than $5^\circ$</td>
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