Boreal Forest Subsistence and the Windigo: Fluctuation of Animal Populations

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RÉSUMÉ

Les psychoses windigo ont été traitées récemment comme des phénomènes d'après contact qui se sont développés à mesure que l'abondance première de gros gibiers a été progressivement diminuée par la traite des fourrures. Cette hypothèse de simple causalité ne tient pas compte de la grande variation des écosystèmes de la forêt boréale. Durant la période précédant le contact aussi bien qu'après le contact, la base de la subsistance des Algonquins du Nord n'était pas constamment abondante ou stable. La fluctuation dans les populations animales a été assez importante pour amener des pénuries de nourriture bien avant le début du dix-neuvième siècle. Le potentiel énergétique de l'écosystème a été tellement sujet à variations dans le temps et dans l'espace que la faim a certainement été une menace durant la période des premiers contacts.

Ideally, mental culture is no longer seen as only superstructure, peripheral to the socio-economic core but connected to it by lines of causation. Practically, there is all too often a tendency for northern cultural ecologists to employ such an assumption, especially when man-environment relationships are seen as direct and one-to-one. One example is a recent analysis of the cause of the Windigo complex among boreal forest Algonkians.

Charles Bishop (1973) relates the increasing incidence of Windigo phenomena through time to an ecological change in the post-contact boreal forest. In this view, an ideological focus on the cannibal spirit is a result of a declining food supply. While

belief in the Windigo cannibal spirit was aboriginal, Windigo psychosis developed because of post-contact food shortages. Starvation occurred as game was depopulated by progressively greater concentrations of people around fur-trading posts. Accelerating frequencies of shortages, and finally starvation, led to greater anxieties, facilitating a heightened concern about famine cannibalism among the Ojibwa.

The corollary to this hypothesis is what is most disturbing. There were no Windigo psychoses before the advent of the fur trade because there was no starvation, a view for which evidence on the great magnitude of kills is presented (1973:13). The threat of starvation was non-existent in pre-contact times. According to Bishop, some Algonkian group did not suffer severe food shortages until the collapse of big game in the early nineteenth century; elsewhere Bishop has documented the breakdown at Osnaburgh House (1974). During pre-contact and well into post-contact times, big game and the Ojibwa existed in equilibrium. The subsistence base of boreal forest Indians is seen by Bishop as both stable and rich until disrupted by outside influences. The ultimate determinant of Windigo psychosis was the dwindling game supply caused by the fur trade. Windigo psychosis among Algonkians was extremely uncommon before European disruption because game was uniformly abundant across the boreal forest (Bishop 1973:13). Such an interpretation of northern game populations appears oversimplified.

Bishop's approach is a form of Stewardian cultural ecology. Because Steward's concept of environment included only its physical and natural aspects, it usually appears in his work as a stable entity. Change comes from outside of the environment, either a creative shift in exploitative technology or a chance extraneous factor, such as European contact. The early contact Ojibwa, indeed any boreal forest Amerindian, have been viewed as possessing a stable adaptation to a rich and static environment. Such a position stands directly contrary to our knowledge of the ecology of northern animal populations. Both large and small game experience oscillations in numbers, frequently of great magnitude, over long and short periods of time. There is great variation in a boreal forest and taiga system. A subsistence base, the productivity of game animals, fluctuates in supply.

The core of Bishop's analysis of Windigo psychosis is the notion of environmental stability before effective European contact. I believe that this idea, based upon one interpretation of seventeenth and eighteenth century historical literature, has not been examined ecologically, Bishop's ecogrammar notwithstanding. While such sources may indicate that the environment was rich, they do not show that it was stable before the increase in the numbers of people utilizing it. In light of Bishop's approach, we must ask ourselves if the relevant carrying capacity, the limit at which the environment can support the human population of hunters, is a constant value, to which Indians adjusted, or if instead the carrying capacity is subject to changes. Bishop makes the assumption that it was not subject to fluctuations before European penetration into an area. Hunters and moose or caribou had a "good" predator-prey relationship, with the Indians living off the interest or the expendable capital. The base of subsistence had not been disrupted; it was stable before the fur trade (Bishop 1973:5). In such a view, a system of checks and balances is seen as operating among the populations. There is little relevant fluctuation of food supply because the traditional societies were well below the carrying capacity of their ecosystem. Bishop does not note the reasons why Indian populations had stabilized at this level. A notion of rich stability should have immediately elicited protest; it does no correspond with the oft-noted pattern among Algonkians and Athapaskans of "feast or famine" (Feit 1969; Knight 1965:32).

Is a subsistence base composed of game populations stable? The specific data needed to resolve such an issue lies only partly in the anthropological literature. Feit, Knight, Helm (1961), and Slobodin (1962) have shown an awareness of animal fluctuations. However, their work, while sophisticated in its approach, does not contain primary information. By far the bulk of the necessary material lies in works on wildlife ecology. While organizing my thinking on this matter, I searched for data on populations of arctic and sub-arctic animals. Population was defined as an aggregation of similar individuals in a continuous area which contains no breeding barriers. Research was oriented around these questions. Do populations of game animals vary from region to region and over time? If they do, was this a pattern of extreme fluctuation?

Lastly, is contemporary information relevant to the early contact period?

Specifically, data of various quality were found on the demographic cycles of certain sub-arctic and tundra animals: mouse, vole, rabbit, grouse, ptarmigan, fox, lynx, muskrat, mink, fish, beaver, elk, deer, moose, and caribou. Population fluctuations appear to exist for all of these categories of animals. These occur at both regular and irregular intervals. Successive peaks in numbers are often of different magnitude. Effects were felt more so in some areas of the continent than others. Some variations in number were random, some periodic, some oscillatory. Population cycles of many animals were related directly, a situation most clearly seen in predator-prey inter-actions. There are in the north four and ten year cycles that have been broadly delimited. In addition, successional changes in the boreal forest directly modify game populations. Certain species exist at optimum numbers in different vegetational stages, a statement that is especially true of deer, elk, moose, caribou, and grouse. There is also the possibility of fish fluctuation.

A cycle implies recurring variations of regular timing and of constant amplitude (Kendeigh 1961:238). Adhering to this definition, most "cycles" are actually oscillations, where both amplitude and timing are inconstant (ibid.). While irregular, most population cycles (to use the most common, though technically incorrect, term) are not entirely random. Two cycles have been delineated; one averages 3-4 years, the other 9-10. Both predators and prey are involved. Each oscillation follows a definite pattern. The basic cycle is that of the herbivores, with predator populations responding to an increased food supply by expanding their own numbers (Kendeigh 1961:241).

The four year cycles involve lemmings and voles, microtine rodents, of the tundra and taiga (Lack 1954:204), as well as hazel grouse (Kendeigh 1961:237). Voles and lemmings have distinct cycles which are not always or everywhere in phase with each other. Their predators oscillate in a corresponding manner, some out of phase with the prey by a year. Peak numbers of the predators follow shortly after that of their prey (Lack 1954:210). Since the preferred food supply of the same predator species vary from region to region, often a single species will follow different

cycles over its range. Marten and red fox have a four year cycle in northern Labrador and Hudson Strait, where they prey on microtine rodents, but in more southerly climes where they prey on the varying hare, they fluctuate in number every ten years.

The important oscillation for our purposes is the cycle of 9-10 years, which is most noticeable in certain boreal forest species. The varying hare (snowshoe rabbit), the ruffed and sharp-tailed grouse, and the willow ptarmigan oscillate in numbers, followed shortly by their predators (Kendeigh 1961:237). Using data obtained from Hudson's Bay Co. fur returns, Butler's study of eight sub-arctic species over thirty years showed that the snowshoe rabbit peaks were followed by those of lynx, arctic fox, fisher, coyote, and wolf. Predator population increases began "about the middle of the snowshoe rabbit peak and continued some years longer" (MacFayden 1969:254).

Ptarmigan, and especially grouse, appear to fluctuate with the varying hare (Kendeigh 1961:238). In any one region, the collapse of all three populations will show a definite pattern. The most common is for the grouse decline to begin a year after the hare decline. Grouse and ptarmigan are the common alternate prey for predators which usually feed on varying hare. When rodents decrease, the expanded predator population rapidly decimates the numbers of grouse (Lack 1954:220-221). From our standpoint, which is concerned with the availability of food to boreal forest Amerindians, the indication that grouse and hare populations oscillate together is a significant one. Convergent declines are especially menacing. Small game, particularly hare, have been noted as very important in the absence of moose or caribou (Bishop 1974:265). A simultaneous collapse of small and large game populations during the winter when fish were relatively unavailable, would have dire consequences.

All of these four and ten year cycles show rather marked regional variations. As well, the 3-4 year oscillations are not apparently synchronous with the 9-10 year ones (Lack 1954:205). Generally, cycles are more distinct in the north, a phenomenon which is most noticeable for individual species. Lack documents the wide agreement that peaks are much larger in the north than the south, when one is considering a single species in its continental range (Lack 1954:212). According to Kendeigh (1961:237):

> South of latitude 45°—50° North in North America and 60° North in Europe, variations in population size appear progressively less extreme and cyclic, more irregular or random in character.

This statement is generally true, which means that it applies on the average and in the long run. Local and regional variations are considerable. As Lack emphasized (1954:212), "peaks are not synchronous everywhere throughout the range". Animal catches frequently show a cycle when considered across a wide area, but fluctuate erratically at individual collecting posts (Lack 1954:211).

Attempts to build mechanistically symetrical models of population cycling have proven difficult. The finite failure rate potential, Finagle's Second Law, intervenes. Local and regional areas are frequently out of phase with the main population peak across Canada. Maritime grouse were three years ahead of the general Canadian peak, while Alaskan grouse were three years behind (Kendeigh 1961:238). Some local peaks are occasionally out of phase by five years, which is the largest discrepancy one would expect in a ten year cycle.

To make matters even less regular, regional peaks are not out of phase consistently. Such variations in tempo do not increase with time; different areas tend to come back into phase by the time of the next peak (Lack 1954:211, Kendeigh 1961:238). Considering game animal populations in any one area, fluctuations occur in amplitude of population peak and decline, in phasing, and in synchrony with other game. When we add to this the chance of purely random accident, such as a herd of pronghorn antelope crashing through the winter ice to their deaths (Dasmann 1964), a considerable amount of instability must be added to the anthropological conception of northern ecosystems. Such variation argues against notions of environmental stability. Clearly, small game and predators are not in static equilibrium.

Some fish species oscillate in number. Sockeye salmon of the Pacific coast appear to have a 3-4 year cycle, while Atlantic salmon have a 9-10 year one (Kendeigh 1961:237). While this is to my knowledge the only 'hard' data provided in the ecological literature, anthropologists have occasionally commented upon the possibility that North American lake fish cycle, or at least vary in supply. June Helm, for example, refers to Slavey fish resources as "subject

to seasonal and yearly fluctuations" (1961:32), much the same as these people's access to barren-ground caribou in the winter. When both failed simultaneously, people died from lack of food. Helm quotes Frank Russel (ibid.):

> The Slaveys, who formerly killed large numbers of caribou between the MacKenzie and the Rae are now compelled to live principally upon fish, and when the fish fail, as they did during the winter (1893) that I spent in the country, they were reduced to actual starvation.

Specific information on the various fish species appears to be limited, generally, to references to the yearly abundance at spawning time, and does not usually consider the differences between the catches of particular years. Helm, in her treatment of the annual catch during the autumn, is an exception.

Cycles similar to those of rabbits or voles, except in duration, have been occasionally mentioned for big game. Ecological evidence is much less definite. The cycles, if they do exist, are of much longer duration than those previously discussed. One sometimes hears mention or 35-70 year cycles for caribou or moose. Direct data are as yet sparse as rabbits in a bad year. Oscillations in big game populations are, needless to say, extremely important to northern Indians.

It is generally conceeded that the availability of plant food interacts with rodent herbivores to produce oscillations in numbers (Lack 1954:213, Kendeigh 1961:241); predation and disease are seen as secondary factors, although this is by no means unanimous. A similar factor is sometimes cited as operating on the moose, an observation made on Isle Royale in Lake Superior. Population increased up to the food limit; thereafter quantity and quality of the vegetation declined. Lack notes (1954:172):

> in 1912 or 1913 a few moose crossed over the ice on Lake Superior to Isle Royale, which is about 45 miles long and 8 to 9 miles wide. By 1930 their numbers had risen to between 1,000 and 3,000 and there were signs of serious overbrowsing. There followed a big decrease, to only 200 by 1935. The numbers then rose again to 500 in 1945 and to 800 in 1948, but they then feel once more, to about 500 in 1950... There have, therefore, been two increases and two declines in numbers, the peaks being about 18 years apart. The declines were accompanied by extensive damage to the vegetation and by starvation of the moose, and it is reasonable to suppose that the moose and their vegetable food have interacted in predator-prey oscillations.

Such irruptions, however, are marginal phenomena, a result of herbivore immigration or humanity's misplaced protection. As in the case of the deer of the Kaibab Plateau, cyclical fluctuations of this sort appear in the absence, or relative absence, of natural predators, such as the wolf, coyote, lion, or man. Leopold has suggested that predators formerly kept large herbivores below the food limit, but evidence is somewhat unclear (Lack 1954:171). However, it is noteworthy that, since wolves were introduced to Isle Royale in 1949, the moose population has stabilized and the browse recovered (Mech 1970:274). Estimates of annual calf production, 225, are remarkably close to annual kill, 140 calves and 83 adults (Mech 1970:273). There is also evidence that wolves control the deer population in Algonquin Park in central Ontario (Mech 1970:274).

Regular moose and deer cycles, when they occur, seem to follow either immigration or protection, phenomena less than common in the long run of contact history. Such oscillations do not correspond with the seemingly stable pattern presented by the Isle Royale study. However, while there appears to be no regular cycles, there is still considerable fluctuation of these animals in the long run. Stability is a relative event. Mech's information was gathered from the period 1959-1966, while his production/kill estimates were taken in 1966. In contrast, vegetational cycles on the order of decades and centuries are also affecting regional game populations.

Different forms of wildlife are related to various stages in the biotic succession of boreal forests (Dasmann 1964:81, Feit 1969): grass, sedge, herbs → brush → deciduous forest → coniferous forest → coniferous climax. For any species living in an area undergoing succession, the amount of preferred food that can be taken is gradually reduced. Different animal populations will eventually die or migrate out of their area as their food resource base is transmuted into a different one through vegetational succession. As deciduous mid-succession merges inexorably with coniferous late succession, most deer, for example, will find their shelter and their preferred food diminishing. Optimum numbers of animals for each species are usually associated with a stage in the vegetational cycle. Stage refers to the frequency of tree species in any given region. Various areas are at different stages of suc-

cession, since "regeneration is conditioned by a large number of variables and is highly uneven" (Feit 1969:113). Stream margins, to cite a case, are usually occupied by alder and willow (Feit 1969:105); periodic spring flooding prevents the growth of larger species or the attainment of climax coniferous. Beyond this, local soil conditions may also affect the attainment of certain stages. Thus, any large region of northern forest will be heterogenous, a noticeably patched quilt of local areas in somewhat different stages of succession, many of them steadily approaching a coniferous climax of black spruce and balsam fir. Among the patches will be water margins and areas already burned out and beginning the cycle once again. A forest fire, or more recently lumbering, over any size area will begin the stages once more.

Small mammals, such as the varying hare, appear in greatest numbers in early successional stages, least frequently in coniferous stages (Feit 1969:112). Moose, elk, and especially white-tailed and mule deer are mid-succession animals (Dasmann 1964:85), depending on leafy browse; ruffed grouse also prefer this stage. Woodland caribou inhabit the climax coniferous forest. Barren ground caribou rely for winter range on a mixture of climax lichens that are intermixed with undisturbed taiga, the 'parkland' between the full boreal forest and the tundra (Dasmann 1964:81).

Mid-succession animals, such as elk, moose, various species of grouse and deer, cannot be permanently maintained in any one area unless that area's vegetation is frequently disturbed (Dasmann 1964:85), which it was not in aboriginal or early contact times. Territorial studies of deer species indicate that most animals of a population will orient themselves to individual ranges and will not leave the area even if they are dying of malnutrition and adequate food is outside (Dasmann 1964:118). Similarly, starving moose are not noted as fleeing Isle Royale. Speaking of elk, moose, white-tailed and mule deer, Dasmann states (1964:85):

> Since usually they will not abandon a home area and move elsewhere, their populations tend to be impermanent. Only a few individuals will move out and colonize newly created habitats. Most will remain on the declining habitat and in time die out... As such, when they are to be used for hunting, liberal regulations governing the take are advisable. There is no point in trying to maintain a permanently high population in a temporary habitat.

Any one territory does not have a stable productivity over time. As the home range advances steadily towards climax, food conditions become less satisfactory through time. Such a situation helps to explain the tendency of unacculturated Indians both to move about and to kill all the food animals they could take, including pregnant ones. After the local area was 'cropped out', it would be left fallow until immigration restocked it. Clearly the pattern Helm found at 'Lynx Point', where newly sedentary Indians still tried to hunt in this fashion but found their yields decreasing, should be instructive.

Moose, however, are in a peculiar situation as there are various disagreements in the ecological literature concerning its mobility and its feeding habits. In studying this, Feit noted that, with the exception of Peterson, all of his sources agreed that moose moved back into an area early in the brush stage and "declined significantly" as the vegetation began to approach coniferous stages (1969:107-108). Summer browse is taken at water margins and in other areas supporting low to mid-succession vegetation. Feit noted that nearly all of the studies were conducted in the northwestern sections of the continent. Beyond this, since they were based on 'pellet' counts, they were probably conducted in the summer. However, Peterson, who seems to have conducted most of his work in the east, believes that moose browse in winter on balsam fir, a tree characteristic of coniferous stages, and not found in significant numbers on burned-over areas (1955, in Feit 1969). Which stage of a burned-over area is unclear, however, since coniferous climax itself is but a stage of a burned-over area. Possibly there are differences between moose populations in various parts of North America, as suggested by Peterson and Feit. If we accept the model, winter → climax/spring, summer → low, mid-succession, then our condition of unreliability of food supply in any one local area is still met, however the ecological controversy is finally resolved. Whether moose are migrating seasonally or after decades or both, or slowly dwindling in any one area or region, the amount of moose that can be captured in one band's territory is not a constant. Conditions and take will vary, seasonally and over a generation.

Woodland caribou undoubtedly inhabit the mature coniferous forests (Feit 1969:109). Beaver migrate into an area during early

stages of succession and remain there until the end of the climax period. Its numbers do not oscillate, but there is a population crash in areas which have suffered recent burns (Ray 1974:120). Because of forest fires which destroy the coniferous vegetation and begin the cycle again, the climax species in any one area are eventually decimated by fire and lack of food. Over a long span of time (Feit estimates about two centuries), the late succession or climax communities in a region are themselves impermanent.

Overall, the amount of variability in most animal populations is significant. If, as Feit argues is suggested by the early contact literature, forest fires were large enough to significantly alter the vegetation of even the most extensive areas, then the various animal populations will be suddenly collapsing. Even if this is not the case, because of the inexorable successional changes, species will be constantly shifting in areal concentration. In any one locale, low and mid-succession species will first proliferate, and then decline as their food resources become scarce. Annual production of certain game will be at first high but will taper off. As those animals that remain are killed, fewer new ones will migrate into the area since it is no longer, for that species, of optimum quality. Some individuals may emigrate, further affecting the local decline in game. It should be remembered that these areas are as variable in size as the forest fires which originally created them; they range from extremely small to very large (Feit 1969:83).

Declines similar to those that affect the mid-succession species, reduced production per area, will also make late climax areas unproductive. The chief difference is that the change from climax, effected by wildfire, will be sudden and catastrophic in its effect on game. With some exceptions, this matter of the role of forest fire in boreal forest ecosystems was competently described by Feit. Migrating barren-ground caribou will shift to a different winter range. while woodland caribou, beaver, and moose will attempt to migrate to a different area. Significant numbers of these animals will starve.

Another factor which adds great complexity and variability to our picture is weather, short term climatic fluctuations of snowfall, temperature, and rain. Sudden, brief thaws that convert the upper layers of snow to hard ice can deprive large game of food

to such an extent that the animals die; such a situation has affected a herd of musk oxen (C.J. Wheeler: per. comm.) as well as barren ground caribou (J.G.E. Smith: per. comm.). Warm winters of little snowfall hamper hunting efforts. With little snow, moose have greater mobility and can more effectively evade pursuit. Barren ground caribou remain longer on the tundra before seeking their winter pasture in the taiga. Excessive rain during spring runoff can flood the burrows of muskrat and drown the young. Conversely, low water levels in the autumn, followed by cold weather, hamper insulation of burrows by mud (Kormondy 1969:91).

Let us picture, then, a population of Amerindians utilizing a region which includes areas of late climax, late middle succession, and low succession water margins. A wildfire, sufficiently strong to leap streams and ponds, burns out a significant part of the late climax forest as well as the alder and willow at water margins. The food supply for both beaver and woodland caribou is destroyed, as is the winter range of moose. Meanwhile, deer yields in the late mid-succession forest areas will have been dropping for several years. This leaves the alternate game: grouse, hare, and fish, all animals whose numbers fluctuate. Grouse and hare reach nadir almost simultaneously. If these lows correspond with a winter absence of larger game, starvation will result, *if the Indians remain in the area.* This is the pattern that affected the Slave in historic times emphases.

Conditions are serious even if we do not postulate a large burn. A relatively small burn outside the band's territory may be sufficient enough to deflect migration routes of wintering barren ground caribou. For any variety of reasons, other animals may not yet have migrated into the region and built up the populations. If even one large species of game fails in the winter when fish are difficult, if not impossible, to obtain, and if alternate prey, hare and grouse populations, have recently collapsed, then I do not find it difficult to conceive of starvation as a serious threat, aboriginally and in early contact times.

Dispersing farther in the food quest, perhaps to relatives in neighbouring bands, may only temporarily alleviate the situation; their condition may be no better than those primarily affected. Even if it is, extra mouths may decrease their own supply. Citing Os-

naburgh material, Bishop documents that hunting groups of large size were sometimes starving in the late eighteenth century (1974:265).

There has been no evidence to prove that such variations, oscillations, successional changes, large fires, and random accident did not operate before European social environments, such as the fur trade, intruded significantly into a region. Simple magnitude of supply in any one year does not provide evidence for continuation of supply at similar levels. This is best illustrated by reference to the situation on Manitoulin Island in the early 1670s, during and after the winter when Nicholas Perrot reported that an Amikwa band had killed 2400 moose there (Bishop 1973:13; Blair 1911:221).

Such a large kill certainly shows that the region was rich in game resources. The *Jesuit Relations* provide interesting additions to this statement of Perrot's. Father André, travelling and preaching across the northern Georgian Bay region from September 1670 to late spring 1671, wrote of severe famine and scarcity of meat among the Ottawa and the Nipissing. Several nations of Ottawa, who had just left Chequamegon, were also living on Manitoulin Island during this winter of 1670-71, a particularly difficult one for them. The hardship of that late fall and early winter, the necessary utilization of a wide variety of plant food, the boiling of old moose skins, the eventual scattering of the Ottawa out of this area to search for game, all noted by Father André, must leave us to wonder at the variation in this rich regional environment. While the Amikwa may have killed 2400 moose on the island that winter, the words of André's journal leave no doubt that game was insufficient to support the Manitoulin Ottawa. The "Outaouacs" were "starving", having "poor success in hunting and fishing". They were subsisting primarily upon roots, acorns, rock tripe, old skins, and very little meat (JR 55:143). Such an account, especially the boiling of skins, is something much more than an inexperienced Jesuit grumbling that Indians do not eat three meals a day like Europeans. Two months spent with the Ottawa exhausted André. Finally, "the continuance and increasing severity of the famine dispersing all the people and closing this mission", André concluded his report next spring with these words (JR 55:155):

> Missionaries to this country of the Outaouacs must know with Saint Paul what it is to experience scarcity much oftener than plenty.

This was in an area which Bishop cites as little affected by European contact. With little game and few fish resources to fall back on, and little nourishing vegetable foods, Ottawa starved. Comparison of Ottawa population estimates over the decade 1665-1675, one based at Chequamegon (JR 50:301) and the later one at Mackinac (JR 1:34), shows a drop in numbers from 2000 to 1300. While war and disease certainly played roles in this, André's report indicates that starvation cannot be dismissed.

From the reports of Jesuits in the northern Great Lakes area during the early contact era, it appears that band territories were not rigidly delineated, especially when neighbouring or allied bands were seeking food or trade. The autumn whitefish runs at Chequamegon served as a focal point for Ottawa and French trade during the late 1660s; hundreds of warriors from many different nations gathered there (JR 50:273-279; JR 54:151). Perrot narrates that some, but not all, Amikwa, Saulteaux, Nipissing, and Ottawa were gathering at the Sault to take advantage of whitefish runs (Blair 1911:179). In light of this as yet limited evidence, it would perhaps be more factual to speak of band ranges rather than sharply defined perceptions of territory that is defended against incursion by 'outsiders'. The exact position of the various Ojibwa nations varied from year to year. This movement might be a response to native estimates as to where an adequate supply of game might be found, taking into consideration which areas had suffered fires over the summer or which had been previously hunted out in recent years. That such estimates as to the best place to winter were occasionally incorrect is one of the vagaries of existence in the northern forests.

Periodic cycles and larger variations in faunal distribution promote wide kin affiliations, an absence of rigidly fixed rules of social organization, and "swidden" hunting. Conservation, the preservation of a proportion of game to ensure local supply, was not generally practised in former times; for example, the Montagnais-Naskapi (Leacock 1954). Slave Indians formerly took all the available moose, even feeding it to their dogs (Helm 1961:32); pregnant cows were not spared. The total moose population of Manitoulin Island appears to have been captured in one winter (J.G.E. Smith: per. comm.). Cree hunters of Rupert House told

Knight "when they trapped, they tried to clean an area out" (1965:32). When this was done, the area was usually left 'fallow' until either immigration restocked it or different animal populations moved in. With such shifting areas of utilization, and with all the variations in game density from place to place, it should seem difficult to hypothesize a lack of starvation, or uniform abundance, before and just after effective contact. That the Ottawa or Nipissing made in the early 1670s a poor ecological judgement as to game supply in their region indicates the characteristically human inability to ever be perfectly in synchrony with an environment. A notion of stability in boreal forest ecosystems is Hiawathan romance.

The variation in animal communities appears considerable. Statements that aboriginal populations utilize between 20% — 50% of the environmental carrying capacity are meaningless in the north, because such calculations are not specific to area, nor are they constant. If we further define the carrying capacity as the accessible food/area, it is always fluctuating through time, circumstance, and region, governed along each parameter by random variations (accident, runoff, temperature, snowfall) and those less random (population and successional cycles).

Human populations, however, do not fluctuate in such a marked manner. If, as Solomon believes, they tend to increase in numbers up to the capacity of the environment, such as "the limit of supply of some essential resource such as food" (1969:53), and this resource frequently varies in supply, then food shortages become inevitable. Such shortages were occuring before the 1820s, when Bishop places the collapse of big game across the boreal forest (1974; 1973). There were Ojibwa suffering starvation in the 1670s, long before Bishop postulates his collapse of big game. Similar inferences can be drawn from the journal of Alexander Henry in the 1760s, who reported that one of several groups of the dispersed Ojibwa he was familiar with had starved over a winter (Henry 1901).

CONCLUSION

The subsistence base, the productivity of game animals, was not uniformly abundant or stable. Variation enters the boreal forest

system in any number of ways: animal cycles, vegetational changes, climax-destroying fires, high and low water levels, variations in temperature and snowfall, immigration and irruption, accidents, hunting out, lack of immigration, and so on. There is little evidence to indicate that this shifting nature has developed solely through European intrusion. While Windigo psychosis may be a post-intrusive phenomenon, as Bishop asserts, starvation was not. A hypothesis of a post-contact Windigo should not rely upon such a theoretical base. A simple causal relationship between mental culture and the socio-economic core is invalid because the 'core' is not the simple stable system it is often pictured to be. Ecological conditions were not static across the full boreal forest or its southern and northern margins. Regions differed, as did local areas, in game density at any particular point in time. Hunting behaviour of Algonkian societies was adjusted to fluctuating conditions before the white man arrived, and after.

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