

A preliminary survey of the **Butterflies** and adult **Odonata**
of the Anderson Properties
in Lincoln Township, Addison Co., Vermont
during part of the 1999 field season.

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Introduction:

This report constitutes the results of surveys of butterflies and adult odonata during four days of the 1999 field season at the Guthrie-Bancroft, Pierce and Wells farms located in Lincoln and Bristol townships of Addison Co., Vermont. These dates were 11 June, 5th and 31 July, and 27 August. Essentially all of my work was in Lincoln township.

Since I was only involved in part-time censusing, I tried to choose as wide a spread of dates as possible across the season to maximize the possibility of encountering both early and late season species. Four days of course is not adequate to make a thorough survey and it is almost certain that the flight period of some species was missed. June and early July, however, is generally when many species of both groups are active. There are also some "late" flying species of both groups, especially of the odonata, that would probably have been over-looked without a sampling period in late August.

I was originally asked to focus on butterflies but I suggested that odonates also be surveyed and was subsequently encouraged to do so. This choice obviously increases the economic efficiency of the resources available to management, since two major insect taxa are being surveyed by a single investigator. Needless to say, however, this has presented some very challenging problems in dealing with various aspects of both the field and laboratory work for this investigator. One field challenge was that of almost simultaneously recording species from both groups. I am quite confident that I didn't "miss" any species although I don't claim to be immune to human error. The other challenge was the usual-the taxonomic imbroglio whenever one works with large (speciose) insect groups. I tried to deal with both problems in the most exemplary way that I could muster.

Butterflies and odonates constitute, in terms of their general biology, quite different ecological groups. Butterflies are basically a terrestrial group and odonates aquatic. If these farm properties are going to be managed with the noble goal of maintaining and even enhancing biodiversity over a period of years, these two insect Orders are potentially excellent candidates as surrogates of environmental conditions that management needs to pay attention to. How this information is used most effectively is a question of much debate, however. Ecosystem management is a very interesting phrase that is becoming more and more omnipresent in conservation circles, especially, in my view, among those who deal more with the applied end of the research spectrum. We do not yet know very much about just how this should be done and, more germane to projects of this type, just how does information about species translate to good management. What type of information is needed and how should this be used? We have to be careful about being iconoclastic in our decision making in environmental management. That is when we focus on the ecosystem level, just what do we mean? Does this imply that information about the biology of specific species is less important? I personally think not. To date many, if not most-of the decisions regarding management are based on physical data and, if biological data are used, it is almost always focused on some aspect of botany and/or those glamorous vertebrates- the birds. More and more authorities feel that there is a great need for information about invertebrates, if we really mean it when we plan to maximize the biodiversity of ecosystems (basically, the assumption here is that management is necessary to reach or approach the maximum diversity of the ecosystem, whatever unit of biodiversity: alpha, gamma, etc., is used). Can this be accomplished if a group is essentially ignored that constitutes roughly 85-90% of all the multi-cellular animal species?

Since I regard this report to be directed primarily at non-professional readers, I have eschewed the general use of in-text documentation. I have listed a selected

bibliography at the end that includes some major references where one can find more information about many of the topics and issues discussed below.

Methods and comments on taxonomy and nomenclature:

All sampling was done by modified "random walks" over the properties. I recorded species in three ways: 1) sight-both when a species could be identified with certainty just by sight and, of course, when I had no choice but to try and render a "best" decision by sight alone when the specimen could not be caught, 2) by netting and releasing-generally, with the odonates, this involved examination of the terminal appendages and the 2nd genitalia (of males) with a "lupe" and 3) by collecting problematic specimens as a voucher for more careful and deliberate examination in the laboratory under a scope. I carried a "field" card that showed the thoracic and other characters of Aeshna with me since many of this genera have very similar thoracic patterns and I wanted to keep collecting to an absolute minimum. To the non-taxonomist (much less the taxonomist), many of the odonates can be very challenging to identify in the field, much less in the laboratory. I did, therefore, collect some of the more problematic taxa as vouchers. Also, I collected some representative butterflies as vouchers, spread and curated them, so that, in the future, a representative set of the local butterfly fauna, including even common species, can be made available for various educational purposes connected to the project.

By studying voucher specimens, "amateurs" can quickly learn the key characters that are useful in identification in the field. Obviously, a good series of photographs would also be helpful. One always assumes that the usual ethical guidelines and any legal restrictions are strictly respected and followed.

I didn't make any attempt to critically evaluate population levels of species. It seemed rather pointless, except in the most general way, with such few census dates. Rather, I concentrated on detecting as many species as possible whenever I was in the field. I did make a few relative population counts, however, when time and conditions permitted. I also tried some mark/recapture with the darners (it turned out, incidentally, to be essentially marking but no recapture-see below) to assess some of the problems associated with this technique since this possibly holds great promise, not just in estimating population levels, but also for studying other important aspects of the biology, especially behavior, of selected species of odonates (M/R techniques are already extremely well entrenched in studies with lepidoptera and have proven to be a very useful tool.

With respect to taxonomy and nomenclature, I took the conservative route. There are several very challenging problems of taxonomy that are currently unresolved with both the local butterfly and odonata fauna. I felt it was best to be conservative in assigning names to specimens and, except for an obvious one, Aeshna interrupta interrupta, I avoided any determinations of subspecies. With the genus Phyciodes, I checked the vouchers carefully and all the males reflected the characteristics of cocyta (northern crescent) and not of tharos (pearl crescent). Some lepidopterists even now don't attempt to separate these two taxa. Also, questionable

records based on sight alone, were not generally included in any type of summations (see tables 1-5). I'm very confident of all my butterfly identifications and quite sure (to suggest a distinction) of my identifications of odonates. However, I have not been able, at this writing, to have any acknowledged authority check the odonate identifications. I don't think this will require any major changes in the tables and, even so, will certainly have little effect on any general analysis where numbers of species are compared among farms, in general, or, more specifically, among specific habitats. However, if I do later become aware of any errors, I will submit a *corrigendum*, for the ultimate record.

Results and Discussion:

I have rather arbitrarily chosen to use common names in listing the species of butterflies since most of them are widely known and used. However, although there is now an official list of common names for odonata, I have decided to only list scientific names. Neither odonate name is currently well known to most non-professionals so I decided to employ the more formal scientific names which have greater stability in the literature. In fact some of the so-called common names of odonates were recently "manufactured" just so such a list could be constructed, whereas the common names of many butterflies have, in many cases, emanated from a long historical/cultural tradition, known to many lay persons. Neither usage has much relevance to this report, however.

I followed the DSA list (Table 5) for the Odonata and Layberry, Hall and Lafontaine's list (1998) for the butterflies (Tables 1-4). (Note, I will not belabor the text by constantly referring to Tables. The reader will know from the context which of the tables to consult. I was asked to provide details of the routes I followed during my sampling efforts at each farm. Some of this information is apparent from a detailed examination of Tables 1-3, and I have provided more information in an appendix by tracing routes of travels on contour maps. I was not completely sure, because of the somewhat limited information provided to me, of all the exact boundary limits of the properties, especially of the Pierce and Wells areas. If I did stray off any property boundary, I'm sure it wasn't much of a transgression in any instance. Any adult butterfly or odonate species recorded a few meters off a property line certainly has little bearing on the validity of any scientific analysis of the ecosystems on the properties, for obvious reasons. In fact, such data probably enhances any such analysis.

Butterflies:

A total of 36 species were positively identified on all farms: 32 at G/B, 15 at P, and 10 at W. However, the sampling effort was quite different at each farm, so the numbers are not directly comparable. This is lower than the combined total of 49 species I recorded this summer at Camp Johnson and the Ethan Allen Firing Range. The sampling at the latter two locales was much more extensive. There are roughly 90 species on the Vt. state list. Therefore, there are probably at least 35 or so more species of butterflies that might occur on the combined three farm properties.

Some obvious vacuae with respect to the composition of the butterfly fauna are:

1. the complete lack of **any** hairstreaks (Satyrrium, Callophrys, and Strymon spp.-to list a few of the genera)

I have no ready explanation for this since, although the dry season precluded the maturation (of the flowers) of some flowering herbaceous species, there certainly were ample flowers at the dogbane flowers in the Bancroft field, in the early season (June) and, though I searched that patch carefully and specifically for hairstreaks, I never saw one.

2. the recording of only one! individual of any species of Polygonia.. I recorded one very worn Grey Comma (progne) on 11 June in the Guthrie woodland.

3. only one record of any Erynnis species. I took one worn icelus, Dreamy Duskywing.

4. no definite records of Aphrodite. Normally, this species is taken in reasonably good numbers, usually along with atlantis, but I never got an unmistakable record, although it is extremely easy to overlook this species in the field. I handled tens of atlantis looking fruitlessly for Aphrodite among the fairly abundant atlantis fritillaries.

5. except for one possible individual of the Black Swallowtail (Papilio sp.) I saw only one other species of Papilio. That was canadensis.

6. the number of species in general seemed quite low, even for a survey that only encompassed four dates but distributed over several months of the flight season.

7. I never positively recorded the Peck's skipper which usually is quite abundant, especially in grassland environments. In fact skippers, save for the Long Dash, the Hobomok, and the "pest" European, were conspicuous by their general absence from the overall butterfly fauna of the area.

8. only one definite record of Pieris napi, the Mustard White. I almost missed a single fresh male individual of the white summer form. I was walking eastward through the woods immediately west of the Guthrie field and saw a white movement some 50 meters or so to my right. I saw it was a butterfly and ran over and netted it. It was my only record of this species for the summer. This was on 5 July (Table 1). Incidentally, if I had been fixated to a transect for a survey of population levels, I would have missed the record, completely. Also, it could easily have been overlooked as "just another cabbage white"!

Not to belabor the point, in general, the butterfly fauna seemed generally pretty depauperate and there were some inexplicable absences of some taxa that one would normally expect to encounter, at least in my general experience in Vt..

The most widespread and abundant butterflies were the: Cabbage White, Clouded (or Yellow) Sulfur, Great Spangled Fritillary, Northern Crescent, Common Ringlet., European Skipper, and the Common Wood Nymph. The European Skipper was present in immense numbers (probably thousands) during the early part of the season (June). Alas, this is not a native species and is even regarded as a pest species (of grasses) in some areas, especially on timothy.

Regarding the duration of flight of any species, I did get one rather late record of the Common Wood Nymph on the 27th of August in the Guthrie field, near the woodland edge. It was a very worn female, barely able to fly. It was the only one I saw

anywhere on the properties on that date. This species is one of the very few satyrids that regularly nectars at flowers. I saw a fairly good number in the Guthrie-Bancroft fields in June and July, attesting to this.

I recorded several species that are, I feel, of considerable interest, from a conservation biology perspective: specifically the Silver-bordered Fritillary which was recorded just on the Guthrie property and the Northern Pearly Eye which, much to my delight was recorded at all three farms, albeit in relatively low numbers (never more than ten during any one census). The former, the Silver-bordered Fritillary, is a species of concern in many more southern northeastern states where it was once relatively abundant. I took one individual in the fairly large clearing of a swamp/marsh complex in the woodland of the Guthrie Farm, west of the field, on 31 July. It is a species of wetlands, especially in the southern part of its range. It (its larva!) feeds on Viola sp.. I think it is a species that is very deserving of careful monitoring and the swamp/marsh complex referred to above is one of the very few large ones on any of the properties. It probably should be periodically managed by cutting so that the shrubs don't eventually fill-in the marsh portion of the area.

Lastly, I would like to stress the importance of the availability of flowers as nectar sources to the butterfly fauna of the farms. On the Bancroft farms there was one relatively large patch of dogbane that attracted the greatest number of butterfly species that I saw anywhere on the three farms. Specifically, on 5th July, in the field of the Bancroft farm I recorded 11 species-6 of these species were actually seen nectaring from the dogbane flowers and others were seen in the patch but not actually nectaring during the 15 mins. that I was taking notes. Unfortunately, this patch was mowed either on 5th July or a day or two later, wiping out what appeared to be the most important nectar source for butterflies on either the Guthrie or Bancroft farms.

In addition, any sites with Joe-Pye-weed attracted many species of butterflies, especially the Speyeria spp. (Great Spangled and Atlantis).

I located six marsh/swamp sites that appear to be **extremely important** for conserving many of the butterfly species of the properties. These are:

1. Guthrie Farm- the site just immediately west of the field (the site mentioned above where the Silver-bordered Fritillary was recorded).

2. Pierce Farm-the marsh/swamp area to the south of the farm house and west of the large field south of the house; the extended marsh along Isham Brook to the northeast of the farm house. The Isham Brook site was the **only place where I recorded** the Least Skipper (31 July).

3. Wells Farm- the two smaller swamps adjacent to the large field: one immediately south of the farm building complex and the other to the nw between the field and the dirt road.

All of these wetland habitats are also extremely important for the odonate fauna. In fact, although I recorded hardly any odonates or butterflies in the marsh/swamp south of the Pierce farm house this year, that site (with Typha and Eupatorium) seems to be a potentially extremely interesting site for both Orders of insects. Unfortunately, I only walked through that swamp once (31st July), the date when I "discovered" it. I predict that some very interesting butterflies and odonates will be recorded from that

wetland area, especially earlier in the season. There is a very high probability of finding the Baltimore Checkerspot and possibly some rather rare skippers such as the Two-spotted Skipper. Undoubtedly, there are also some interesting odonates to be found.

One fairly obvious threat to the butterfly species at all three farms is the complete mowing of the fields which I observed, in part, and which I presume occurs annually. Also, some of the paths or trails in the woods west of the Guthrie and Bancroft fields had been closely and extensively mowed. Such mowing not only destroys larval food plants for many species but it also eliminates nectar sources (as mentioned above). Any effective ecosystem management plan must take this into account. I recommend that considerable thought be given to both the extent and the timing of the mowing, if reducing deleterious effects on a butterfly fauna are deemed to have a high priority. I don't mean to imply that mowing should be completely stopped but certainly some changes from the current protocol of mowing seem desirable. One cautionary note to any seemingly simple and sweeping apparent solution of this type is that it should not be regarded as a panacea to, say, enhancing the butterfly fauna. For example, many species of butterflies have very specific food plant requirements for their larvae and simply changing a mowing regime may not be enough to counter a decline in butterfly diversity. We must know more about specific species.

Fields are where most of our exotic or alien species abound. Some of the western native grassland species, such as the Clouded and the Orange Sulphurs, which have presumably recently invaded the northeast, are also most common in fields. In terms of priority, I think management practices that enhance the suitability of non-field habitats: such as swamp, and marsh habitats (where many of our more interesting native species live), should be ranked highest on the scale of critical management issues. As one example of a presumably simple management strategy, I would recommend leaving piles of brush, cut logs, and other debris in woodlands, even if selected low-impact logging is practiced. A number of our butterfly species (e.g., **Polygonia** spp.)-not just the well-known Mourning Cloak, winter over as adults and there is evidence that such "debris" is critical to them for hibernacula. A highly sanitized "clean" woodlot may look appealing, but, in general, it is disastrous for many species of organisms that are adapted to natural woodland environments. Witness, for example, the well-known depauperate biodiversity of the extremely intensively managed Black Forest of Germany. We need the so-called "dirty" or unkempt woodlands. The evidence is now almost overwhelming with respect to supporting the view that **dead** woody material is extremely critical to maintaining and enhancing biodiversity, especially of-but not restricted to-insects. However, whatever management strategy is implemented, we must be also careful to monitor its effect. We mustn't glibly assume that any broad-based (ecosystem) management strategy will ipso facto guarantee the attainment of our goal to maximize biodiversity over a relatively long period of time, much less in perpetuity. The key problem in monitoring of course is to know what to monitor. There are no easy answers. However, one must act. using the

best information available and then exercise management in a very intelligent manner.

Odonates:

The basic survey data regarding the odonate fauna of the three farms is presented in Table 5. This fauna was very limited in terms of numbers of species. A theoretical total of 26 species was noted of which 24 were definitely identified. I'm reasonably certain that there were other species of Aeshna present- (probably either or both of canadensis and eremita) and almost certainly an UID (unidentified) Somatochlora sp. that I saw amid some Alnus along Isham brook on 31 July.

The total of 26 species is far less than the 55 or 56 species that I recorded this summer at two sites in nw Vermont. I am unaware of any published detailed lists of adult odonate species for any Vt. locale, thus comparisons with other sites in Vt. is tenuous at best. There are of course a number of very general lists available such as Dr. Frank Carle's and others (Nothnagle's e.g.). None of these contain specific data with respect to specific sites, much less to habitats at a site.

The limited data base precludes anything but the broadest generalizations. If I had sampled earlier, I undoubtedly would have observed some of the early spring species such as Epitheca canis. The complete lack of gomphid records is probably because of the general lack of streams, much less rivers, on the farms, and the limited sampling. For example, Isham brook almost certainly harbors some species of gomphids and undoubtedly Boyeria sp. along its reach.

There were three sites where adult odonates were most abundant. These were the marsh/swamp woodland clearing area, west of the Guthrie field (already mentioned above); the Isham Brook area of the Pierce farm, especially around the beaver pond area northeast of the house; and, the beautiful little pond in Guthrie field. This pond, incidentally, barely showed any decrease in depth during the extremely dry summer whereas most of the swamps and marshes were "bone" dry, or nearly so, by the end of the sampling period. Isham Brook, however, still flowed steadily during the entire period that I was in the area.

I recorded a very respectable total of 13 species of odonates from the beaver meadow site (at the Pierce farm) on 31 July and, coincidentally, over the course of several checks over the sampling period, the same total at the small pond in the Guthrie field. That is, roughly 50% of the maximum number of all the odonate species recorded on the farms were recorded at **each** of these two sites.

I did not detect any species that I considered unusual, rare, endangered or whatever category of concern or interest one might articulate. There were many taxa, other than those mentioned above, that seemed, as they say, "conspicuous by their absence". Even with the limited sampling and the obvious paucity of aquatic habitats on the farms, especially during this extremely dry year, there were some startling deficiencies in the list of species. Among these were:

1. only one Lestes (spreadwing) species was recorded-normally one would expect at least five
2. no A. canadensis was positively recorded. I am almost certain that there were one-or even two other Aeshna species present. I was never able to net and positively identify a number of individuals of Aeshna.

3. only one species of Somatochlora was recorded, the fairly common and beautiful tenebrosa. Interestingly, I recorded only two and both were females, flying over the Joe-Pye weed patch west of the Guthrie meadow. This was on the 5th July in the relatively early morning (circa 0930). I never saw this species at the nearby pond in the Guthrie meadow.

4. I recorded a surprisingly low total of 10 skimmers (Libellulidae). This was probably because many of the ponds had dried-up throughout the area. Furthermore, there were very few ponds on the three farms. There were two on the Pierce farm, both very small; one man-made on the Wells farm; and one on the Guthrie farm. Of all these ponds, only the latter seemed to have much odonate diversity (13 species were recorded compared to 0-5 at the others).

5. I found only one Enallagma species (aspersum) to be quite common. This is a species that is reported to be common as well as one that flies relatively late in the season. On the other hand, E. ebrium, which is generally quite common and widespread, was taken only at the Pierce farm.

I did employ a mark/recapture exercise at the Guthrie pond. This was an invaluable experience for me and also, much to my delight and puzzlement, revealed an interesting problem in odonate behavior. I mention this because I think studies of biodiversity are much, much more than simply listing species and even recording densities. That is, if we really wish to preserve species, we must understand many other aspects of their biology so that we can glean the best information most vital to making well-informed decisions about their conservation. Behavior is one aspect of a species' biology that could-I'd rather say does-provide such information. Furthermore, if one wishes to raise the standard of concern for the conservation of species, one has to stimulate people to do so. Getting people interested in the study of the behavior of organisms (and this includes plants, by the way) is one approach that could possibly foster more interest in and support of conservation biology issues. Behavioral studies are usually fascinating to most people. Witness for example, the widespread interest in the work (essentially all in the field) of those three Nobel Prize laureates: Lorenz, Tinbergen and von Frisch.

I employed a Sharpie pen (the same type used in most marking of butterflies) to mark the odonates. On 31 July., between 1500 and 1540 hrs (DST), I marked all the darners I could net: namely five A. interrupta. All were males. After marking, they all appeared to **immediately** fly away from the pond. (Incidentally, I estimated at the **same time** there were some 30-50 bluets (probably all Enallagma asperum) at the pond). I arrived at the not startling conclusion, that interrupta was the commonest, if not the **only**-species of darter at the pond. However, I had a nagging thought of "what if". Therefore, I went back to the pond again from 1727-1745 hrs DST and tried some more marking. Much to my utter surprise, of all the six darners that I netted and marked, all were females, and all were umbrosa! Nary an interrupta was to be seen! Nor, did I ever get a recapture of any marked individual of either species.

In addition, I saw not a single Enallagma during the 2nd visit to the pond. Where were they? I looked carefully for any bluets in and among the dense

vegetation bordering the pond, but in some five minutes or so of searching, I saw none. It would be very interesting to know where E. asperum was roosting during its period of inactivity. The roosting site must be at the pond, but where?

Need I say more about the value of that little pond in the Guthrie field from which I recorded 13 species of odonates over the season and where I obtained some very provocative data about odonate behavior, behavior which I've never seen actually documented (with numbers!) anywhere else? That is, one species, Aeshna umbrosa, seemed to completely replace another, A. interrupta, in a matter of hours. Why? And where were the male umbrosa and the E. asperum at the second check? What was going on? Was this a general (activity) pattern that repeats itself on a daily basis or was it just an artifact of limited sampling? I suspect that the relative activity patterns of the Aeshna species are at least partially influenced by (biological) interactions with other species. However, I think the bluet was absent in the latter part of the day because of some purely physical effect of the environment, probably a decrease in ambient temperature. More data are obviously needed to better understand these fascinating questions. Almost anyone, with some interest and training in conservation biology and ecology, could make some very significant contributions to elucidating these questions.

In conclusion, in terms of management practices, that small pond at the Guthrie field seems very important to many species of the odonate fauna in the general area. More importantly, it could be used as a **model pond to study odonate behavior**. It has many attributes that make it almost ideal for that purpose: good access, size, and a relatively protected location. The Guthrie pond clearly needs to be protected. I also recommend the development of a much wider zone of uncut vegetation around the **entire** perimeter of the pond. Many so-called aquatic insects absolutely require an undisturbed edge to complete their life cycles. I saw, for example, one Aeshna ovipositing in a dried-up cattail along the edge. I wasn't sure of the species of the odonate. This observation is significant because it clearly signals that at least one species of damer apparently uses that pond for reproduction, not only as a place to forage for insects. This is not unexpected but just which of the 13 species recorded at the pond use it for reproduction (namely ovipositing and as a place for the larvae to mature to the imago)? We don't know the answer to this question.

Other possible management practices to enhance odonate diversity might include the possibility of digging some other ponds on the properties. Also, Isham Brook needs to be protected from excess siltation and other anthropogenic activities that would degrade its quality. This should include the elimination of any major source of non-point runoff of salts, pesticides, herbicides, and other potentially toxic or degrading chemicals (such as excess nitrates), both inorganic and organic.

Finally, with respect to the odonate fauna of the properties, studies on the ecology of the larval stages must be done. One problem with relating data primarily from adult odonates to on-site management practices is that the adults that are recorded may not be reproducing at the site. That is, the site may just be a habitat for feeding and not for reproduction of the species. Ostensibly, it is data on the reproduction of the species that has the highest priority in making informed decisions

about perpetuating **breeding** populations of any species at any site.

Other fauna:

Although I didn't spend much time observing other fauna, I did collect some carabids along the Isham Brook where it flows through the woodland south of the Pierce farm; some are tentatively identified but I shall not report on them here. I'd emphasize that the portion of that brook that runs near to or through the Pierce farm, is an absolutely magnificent stretch of water. It, too, needs to be protected and studied. The entire watershed of that stream could be the object of a major conservation effort that could and should entail the support of all the landowners living on the watershed. I think such an effort would ultimately provide a broader base of public support and understanding of the entire project.

I definitely saw a species of plethodontid salamander along that stream, namely Eurycea bislineata, the two-lined salamander, a truly magnificent beast! This was on 31 July.

Needless to say, most aquatic environments, lentic or lotic, permanent or not, are also very important for amphibians, aquatic snails and many groups of aquatic insects.

Summary:

During a four day sampling period of the three Anderson farms, a relatively depauperate fauna of butterflies and odonates was recorded, albeit not one without interest.

No listed State or Federal species of any taxa were found though interesting butterfly species such as the Northern Pearly Eye and the Silver-bordered Fritillary were recorded. Only one Mustard White was recorded. The exotic European Skipper was the most common species of butterfly; other, all meadow species of butterflies, were also relatively common.

Enallagma aspersum, the Azure Bluet, was the most numerous species of odonate present.

The exceedingly dry weather may have been partly responsible for the low diversity of both major groups: odonates and lepidoptera, at least on a temporal basis. However, other factors were undoubtedly mitigating such as the extensive annual mowing of grassland habitats at times when nectar-providing plants were at peak maturity.

A mark/recapture of odonates was attempted, resulting in some rather inexplicable results that suggest that much further study is needed. The Guthrie pond could serve as a field model for such studies. Various management strategies for enhancing the biodiversity of these groups was discussed, including:

1. butterfly biodiversity could possibly be enhanced by changing the mowing regime of the fields so that there is a more constant and seasonally timely source of both nectar and larval food plants. Also, woodlands could be managed so that more natural debris and vegetation remain.

2. odonate biodiversity could possibly be enhanced by: 1) building some more ponds, 2) protecting the ecological integrity of Isham Creek, and 3) giving especial

protection to wetland habitats. The Guthrie meadow pond is identified as an aquatic site of great importance both for maintaining the diversity of odonates and to serve as a potential model site for field studies of odonate behavior

3. more studies are clearly needed to fine tune management strategies for the future, with particular emphasis on developing a wider data base about **invertebrate** species that includes a broad well-conceived array of information relevant, especially, to elucidating the reproductive biology and behavior of the species, the communities that they constitute, and the ecosystems that they live in, with respect to both function and structure.

4. a broad-based community-oriented program could be developed that focuses on the Isham Brook watershed as a landscape scale study to enhance the biodiversity of the entire watershed.

I might conclude that one deficiency of my effort was the limited time that I had to spend on the three areas. I never surveyed any of the Baldwin Creek area and I strongly suspect that its watershed, too, could be developed as a model of conservation biology as a joint project with possible work on the watershed of Isham Brook. My guess is that other funding might be available for such studies.

All the opinions, errors, and other omissions and commissions are mine along. I have not discussed any of the statements rendered here with anyone *a priori* to writing this, MS, nor do any of them deliberately support or reject the views of any specific public or private persons or organizations with which I might have a common interest. I welcome any constructive comments from any and all interested readers. Thank you.

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Appendix IA -IE Generalized routes followed on the Guthrie-Bancroft and the Pierce farms during 1999 (see the following topographic sheets).

A-G-B on 11th June-note ; location of the woodland swamp/marsh, the small pond in the Guthrie field, and the dogbane patch, all described in the text.
B-G-B on 5th July
C-G-B on 31 July
D-G-B on 27 Aug.
E-Pierce farm-on 31 July

I had no suitable map of the Wells property. However, the routes I followed when sampling at this property were generally the same, to wit:

5 July- field and swamp to the south and east of the homestead than east to just beyond the top of the height of land and than back across the field to the east. At this time the field was quite wet, even though it had been quite dry.

27 August- as above but well beyond the height of land downhill east to the wooded valley below. I saw no boundary markers here. Then, back to the field and westward across to the field into the swamp/marsh at the nw corner of the field.

At this date the field was quite dry and the small man-made pond nw of the house was almost empty.

Despite all the routes I followed through the various woodlands, very few butterflies or odonates were recorded in any woodland proper, as compared to clearings in the woodlands. The only butterflies that occurred in woodlands "regularly" were: the Canadian S., the N. Pearly Eye, the Mourning Cloak and the Mustard White. The Atlantis F. was regularly seen along some of the woodland trails. I had, however, only one record each of the Mourning Cloak and the Mustard White, both known to be classic woodland dwelling species.

Table 1. Preliminary Checklist of Butterflies Recorded During the Summer of 1999 at the Guthrie/Bancroft farms on 11 June (**bold**), July 5th (lc) and 31st July (uc) in Addison County, Lincoln Twp., Vermont. *

sites	Guthrie		Bancroft	
	F	W	F	F(n)
Papilionidae-swallowtails				
black s.	....	....	....	....
E. tiger s.	....	....	....	....
Canadian s.	... X	....	....	.N ...
Pieridae-whites and sulfurs				
mustard white	....	.V..	....	....
cabbage white	..?...	..X...	..?...	....
Clouded S.	..x. X....	....	....	....
Orange S.	..X.V..	....	....	....
Lycaenidae-harvesters, coppers, hairstreaks and blues				
Am. copper	... X..	....	....	....
E. pine elfin	....	....	....	....
e-tailed blue	....	....	....	....
spring azure	..x. X..	..v..	..X..	..n...
silvery blue	.. X..	....	....	....
Nymphalidae-brush-footed b.: fritillaries, crescents, anglewings, admirals and wood-nymphs				
great spangled f.	..X...	..x X...	..X...	.v(n)
aphrodite	..?...	....	....	....
atlantis f.	..V.V..	.V. x	....	.n..
silver-bordered f.	.. V..	..X...	....	..N ...
meadow f.	....	....	.v...	.n...
Harris's checkerspot	X...	..X...	....	....
pearl crescent	....	....	....	....
northern crescent	..xX....	..x...	....	..N ...
Question mark	..x...	..X...	....	....
grey comma	....	..X...	....	....
mourning cloak	....	....	....	....
Milbert's t.	..XV..	....	....	..x N ...
American lady	..?...	....	....	....
white admiral	... X..	....	....	..x...
viceroi	... X...	....	....	....
N. pearly eye	....	..vX..	....	....
eyed brown	....	..X...	....	....
little wood satyr	.. X...	....	....	..x...
Common ringlet	..x. X..	....	....	..n N ...
common wood- n	.v.X...	..X...	..X...	.n....

Table 1. Preliminary Checklist of Butterflies Recorded During the Summer of 1999 at the Guthrie/Bancroft farms on 11 June (**bold**), July 5th (lc) and 31st July (uc) in Addison County, Lincoln Twp., Vermont (cont.) *

sites	Guthrie		Bancroft	
	F	W	F	F(n)
Danainae-Milkweed butterflies				
monarch	..X...	.....	.....	.....
Hesperiidae-Skippers				
Pyrginae-Pyrgine skippers				
silver-spotted s.	..?...	.....	.....	..?....
dreamy duskywing	..X...	.....	.....	.....
Heteropterinae-Intermediate skippers				
Arctic s.	..X...	.....	.....	.....
Hesperiinae-Branded skippers				
least skipper	.....	.....	.....	.....
long dash	..X...	..X...	.....	..X...
Peck's s.	.....	.....	.....	.....
tawny-edged s.	..X...	.....	..v...	..N...
n. broken dash	.....	.....	.....	.....
dun s.	..vX..	.....	..xV...	.....
hobomok s.	..X...	..X...	.....	..N...
European s.	..xX..	..X...	..X...	..xN...
<hr/>				
total species:	11VI.....19.....	2.....	0.....	8.....
	5th VII.....9.....	11.....	7.....	11.....
	31 VII.....8.....	6.....	1.....	0.....
all dates:	26	16	7	16
				All species=32

*Notes: code:v=voucher specimen, x=record (definite visual or netted (without voucher), ?- possible visual sighting- thought to be species (not included in totals), n=nectaring at dogbane patch in Bancroft field.

F=field (inc. dried-up marsh nearby Guthrie field); W=woodland (inc. dried-up marsh/swamp in the woodland to west of fields)

Species with no records during the census dates, but possibly in area, during the season, are also included in the table but **not** in the column totals.

11 June records in bold case; 5th July records in lower case (lc); 31st July records in upper case (uc)

Totals: (totals do not include the question marks (?))

11th June

number of species recorded= 21

dogbane patch in full flower: number of species nectaring at dogbane patch= 8

5th July

number of species recorded=20

number of species nectaring at dogbane patch=11 (recorded before mowing)

31st July

number of species recorded=9 none at dogbane patch

dogbane patch mostly not in flower (growing back from mowing on 5th July)

Table 2. Preliminary Checklist of Butterflies Recorded During July of 1999 at Wells (5 July) and the Pierce (31 July) farms in Addison Co., Lincoln Twp., Vermont (cont.).*

sites	Wells		Fields	Pierce	
	Field	Woods		Woods	Marsh
Danainae-Milkweed butterflies					
monarchX..	.....	.....
Hesperiidae-Skippers					
Pyrginae-Pyrgine skippers					
silver-spotted s.
dreamy duskywing
Heteropterinae-Intermediate skippers					
Arctic s.
Hesperiinae-Branded skippers					
least skipperV..
long dashx(edge)	.....	.....	.....
Peck's s.
tawny-edged s.
n. broken dash
dun s.x(edge)	.....	.....	.....
hobomok s.
European s.	..X..	.....	.....	.....	.....
total species	3	3	7	7	5

Notes: code:v=voucher specimen, x=record (definite visual or netted(without voucher).?=possible visual sighting thought to be species (not included in totals).

F=field environment, W=woodland (secondary, mixed deciduous), M=beaver meadow marsh

Some species with no records during the census dates, but possibly in area during the season, are also included in the table but **not** in any of the column totals.

Total species: Pierce Farm=15; Wells Farm=6 **Both farms= 21**

Table 2. Preliminary Checklist of Butterflies Recorded During July of 1999 at Wells (5 July) and the Pierce (31 July) farms in Addison Co., Lincoln Twp., Vermont. *

sites	Wells		Pierce Fields	Pierce Woods	Marsh
	Field	Woods			
Papilionidae-swallowtails					
<i>Papilio</i> sp.X..	.....
E. tiger s.
Canadian s.
Pieridae-whites and sulfurs					
mustard white
cabbage white	?..	..X..	.....	..X..
Clouded S.X..	.....	..X..
Orange S.V..	.....	..?..
Lycaenidae-harvesters, coppers, hairstreaks and blues					
Am. copper
E. pine elfin
e-tailed blueV..
spring azure	..X..	.....	.....	.....	.....
silvery blue
Nymphalidae-brush-footed b.: fritillaries, crescents, anglewings, .admirals and wood-nymphs					
great spangled f.X...	..?..
aphrodite	..?..?..
atlantis fV..	.....
silver-bordered f.
meadow f.
pearl crescent
northern crescentX..	.....	.....
Question mark
grey comma
mourning cloakX..	.....	.....	.....
Milbert's t.
American lady
white admiralX..	.....
viceroyX..	..X..
N. pearly eyeX..	.....
eyed brown	..X..	.....	.....	.....	.....
Appalachian brown
little wood satyr
Common ringletX..	.....	.....
common wood- nX..	..x(edge)	.....

Table 3. Preliminary Checklist of Butterflies Recorded during 27th Aug. 1999 at the Guthrie/Bancroft and Wells farms in Addison Co., Lincoln Twp., Vermont*

sites	Guthrie/Bancroft			Wells	
	F	F/M	M/W	M/S	F
Papilionidae-swallowtails					
Canadian s.
Pieridae-whites and sulfurs					
cabbage white	..X..	.....	?....	.....	.....
Clouded S.	..X..	..X..	..X..	.....	..X..
Orange S.	..X..	.....	.....	.....	.....
Lycaenidae-harvesters, coppers, hairstreaks and blues					
Am. copper
E. pine elfin
e-tailed blue
spring azure
silvery blue
Nymphalidae-brush-footed b.: fritillaries, crescents, anglewings, admirals and wood-nymphs					
great spangled f.	?....
aphrodite
atlantis fV..	.....	..X..	.....
silver-bordered f.
meadow f.	..V..	.....	.....	.....	.....
Harris's checkerspot
pearl crescent
northern crescent?..
Question mark
grey comma
mourning cloak
Milbert's t.
Vanessa sp.X..	.....	.....
American lady
white admiral
viceroy?..
N. pearly eye
eyed brown
little wood satyr
Common ringlet	..X..	..X..	.....	.....	..X..
common wood- n	x(edge)	.....	.....	.....	.....

Table 3. Preliminary Checklist of Butterflies Recorded during 27th Aug. 1999 at the Guthrie/Bancroft and Wells farms in Addison Co., Lincoln Twp., Vermont (cont.).*

sites	Guthrie/Bancroft			Wells**	
	F	F/M	M/W	M/S	F
Danainae-Milkweed butterflies					
monarch	.....	..X...	..X...	..X...	.....
Hesperiidae-Skippers					
No skippers recorded					
total species	6	4	4	2	2

*Notes: code:v=voucher specimen, x=record (definite visual or netted(without voucher).?=possible visual sighting thought to be species (not included in totals).

F=field environment, F/M=marsh near field, W=woodland (secondary, mixed deciduous and coniferous), M/W= dried marsh surrounded by woods, M/S=mixed marsh and swamp adjacent to field.

**Walked through woods at Wells farm this date but no butterflies recorded.

Some species with no records during the census dates, but possibly in area during the season, are also included in the table but **not** in any of the column totals.

Total species: Guthrie/Bancroft Farm=8; Wells Farm=4 **Both farms=8**

(Field areas completely mowed over, including some of the major trails into the woods west of the Guthrie/Bancroft fields.)

Table 4. Preliminary Checklist of all Butterflies Recorded During the Summer of 1999 at the Guthrie/Bancroft (G/B), Pierce (P) and Wells (W) farms, Addison County, Vt. with a zoogeographic categorization by range in eastern N.America.*

	Range	Farms		
		G/B	P	W
Papilionidae-swallowtails				
<i>Papilio</i> sp.	....	....	.X..	....
Canadian s.	..N.	.X..	....	....
Pieridae-whites and sulfurs				
mustard white	. N..	.X..	....	....
cabbage white	.. E (alien)	X ..	..X..	....
Clouded S.	...E..	.X.	..X.	..X..
Orange S.	...E..	.X..	..X..	....
Lycaenidae-harvesters, coppers, hairstreaks and blues				
Am. copper	...N..	.X..	....	....
e-tailed blue	..E..	....	..X..	....
spring azure	..N..	.X..	....	..X..
silvery blue	...N..	.X..	....	....
Nymphalidae-brush-footed b.: fritillaries, crescents, anglewings, admirals and wood-nymphs				
great spangled f.	. E..	.X..	..X..	....
atlantis f.	.. N..	.X..	..X..	..X..
silver-bordered f.	.. N..	.X..	....	....
meadow f.	.. N..	.X..	....	....
Harris's checkerspot	.N..	.X..	....	....
northern crescent	..N..	.X..	..X..	....
Question mark	...E..	.X..	....	....
grey comma	...N..	.X..	....	....
mourning cloak	...E..	....	....	..X..
Milbert's t.	...N..	.X..	....	....
<i>Vanessa</i> sp.	..E..	.X..	....	....
white admiral	..E..	....	....	....
viceroi	...E..	.X..	..X..	....
N. pearly eye	...N..	.X..	..X..	..X..
eyed brown	...N..	.X..	....	....
little wood satyr	...E..	.X..	....	....
Common ringlet	...N..	.X..	..X..	..X..
common wood- n	...E..	.X..	..X..	....
monarch	..E..	.X..	..X..	..X..

Table 4. Preliminary Checklist of all Butterflies Recorded During the Summer of 1999 at the Guthrie/Bancroft (G/B), Pierce (P) and Wells (W) farms, Addison County, Vt. with a zoogeographic categorization by range in eastern N.America (cont.)*

	Range	Farms		
		G/B	P	W
Hesperiidae-Skippers				
Pyrginae-Pyrgine skippers				
dreamy duskywing	..N..	..X..	.....	.....
Heteropterinae-Intermediate skippers				
Arctic s.	..N..	..X..	.....	.....
Hesperiinae-Branded skippers				
least skipper	..E.	.....	..X..	.....
long dash	...N..	..X..	.....	..X..
tawny-edged s.	...E..	..X..	.....	..X..
dun s.	...E..	..X..	.....	.....
hobomok s.	...N..	..X..	.....	.....
European s.(alien)	...N..	..X..	.....	..X..
total species by farm		32	15	10
grand total of all three farms=	36			

*Notes: code: for the general zoogeographic ranges N=species that have ranges that extend well into Canada but, generally, are absent from the southeasterh U.S.; E= species that have ranges that encompass most of the e. U.S. (e.g.,east of the Miss. River) except, in most cases, for Florida.

Table 5. Odonates recorded at the Guthrie/Bancroft (G), Pierce(P) and Wells (W) farms in Lincoln Twp., Addison Co., Vt. during four days of the 1999 field season.*

	Farm Location	Zoogeographic Range
Calopterygidae-BROAD-WINGED Damselflies		
<i>Calopteryx maculata</i>	..... P.....	...E..
Lestidae-SPREADWINGS		
<i>Lestes disjunctus</i>	..... GP.....	...N..
Coenagrionidae-POND DAMSELS		
<i>Enallagma aspersum</i>	.....GP.....	...E..
<i>E. ebrium</i>	.....P.....	...N..
<i>E. cyathigerum/vernale</i>	.....G.....	...N..
<i>E. hageni</i>	.....G.P.....	...N..
<i>Ishnura posita</i>	.....P.....	..NES
<i>I. verticalis</i>	.....GP.....	...E..
<i>Nehalennia irene</i>	.....G.....	...E..
Aeshidae-DARNERS		
<i>Aeshna sp.</i>	....GPW....	.....
<i>A. i. interrupta</i>	.... G .....	...N..
<i>A. umbrosa</i>	.....G.....	...E..
<i>Anax junius</i>	.....G.....	..NES.
Gomphidae-CLUBTAILS	(none recorded)	
Cordulesgastridae-SPIKETAILED	(none recorded)	
Macomiidae-CRUISERS	(none recorded)	
Corduliidae-EMERALDS		
<i>Cordulia shurtleffi</i>	.....G P?..	...N..
<i>Somatochlora sp.?</i>	.....P.....	.....
<i>Somatochlora tenebrosa</i>	.....G.....	...NE.
Libellulidae-SKIMMERS		
<i>Leucorrhinia glacialis</i>	.....G.....	...N..
<i>L. proxima</i>	.....G.....	...N..
<i>Libellula julia</i>	.....G.....	...N..
<i>L. lydia</i>	.....P.....	...E..
<i>L. pulchella</i>	.....P.....	...E..
<i>L. quadrimaculata</i>	.....G.....	...N..
<i>Sympetrum internum/janae</i>	.....G.....	.. E..
<i>S. obtrusum</i>	.....GP...	.. N..
<i>S. semicinctum</i>	.....P.....	...N..
<i>S. vicinum</i>	.....G.....	...E..

*Nomenclature follows Dragonfly Society of the America (DSA) list of Aug. 1996 (Argia vol.8)
Geographic ranges are interpolated **extremely generally** from Paulson and Dunkle's (A checklist of N. American Odonata, Slater Mus. Nat. Hist., U. Puget Sound, Occ. Paper No. 56, 1999).

N=primarily northern (well into Canada); E= most of the eastern U.S.; S=a distribution that includes most, if not all, of the southeastern states and perhaps even into the southwest to Mexico and even S.America; NES=a species with essentially a continental-wide distribution

Selected Bibliography*

Lepidoptera:

Glassberg, Jeffrey 1999. Butterflies through binoculars-the east. Oxford Univ. Press, NY, 242 pp. + end plates. (extremely good for detailed field characters and I used this for the range evaluations)

Grehan, John L. et al 1995. Moths and butterflies of Vermont (Lepidoptera)-a faunal checklist. Agric. Expt. Sta., U.Vt., Dept. Forests, Parks and recreation, St. of Vermont, Misc.Publ. 116, Vt. Monitoring Coop. Bull., No. 1, Jan. 1995, 94 pp.. (although already dated, esp. for moths, it still stands as one of the most complete lists of lepidoptera for any state and is essentially complete for butterflies).

Layberry, Ross A., P.W.Hall, and J. Donald Lafontaine. 1998. The butterflies of Canada. U.Toronto P., 280 pp..(excellent- a must for any serious student in the n. U.S. states).

Odonata:

Carle, Frank (no date). An unpublished (MS) entitled An illustrated key to the adult dragonflies (Anisoptera) of New England, Univ.of Vt., Burlington. (useful keys-Dr.Ross Bell, UVM, kindly brought this to my attention).

_____ 1994. Dragonflies and damselflies (Odonata) known or likely to occur in Vermont. Nongame & Natural Heritage Program, Vt. Fish & Wildlife Dept., Waterbury, 18 pp..

Dunkle, Sidney W. 1989. Dragonflies of the Fla. peninsula, Bermuda and the Bahamas. Sci. Publ., Gainesville, Wash., 154 pp..

_____ 1990. Damselflies of Fla.,Bermuda and the Bahamas Ibid., 148 pp..

(The two above are "sister" publications and both superb. Although dealing with Fla., the family descriptions are extremely enlightening and some of our species do occur in Fla.. Dr.Dunkle's new field guide on anisoptera was, unfortunately, not in print in time for use in this study.)

Paulson, Dennis R. and SW. Dunkle 1999. A checklist of North American Odonata. Slater Mus. Nat. Hist., U. Puget Sound, Occ. Paper No. 56, 86 pp..

(I used this for range evaluations).

Pilon, Jean-Guy and Denise Lagace' 1998. Les odonates du Qubec, Entomofaune du Quebec (EQ)Inc., Chicoutimi ,Quebec, Canada, 367 pp.. (I found the keys to be extremely useful).

Needham, J.G. and M.J. Westfall, Jr. 1954 (reprint of 1975 ed.). A manual of the Dragonflies of North America, U. Calif. P., 615 pp.. (an old classic-Dr. Westfall has recently completed a revised version).

Thomas, Michael C. and David L. Wagner. (no date). MS. An identification guide to the male damselflies. unpublished, Univ. Ct., Dept. of Ecology and Evolutionary Biology, Storrs. (elementary but very useful).

Walker, Edmund W. 1953 (vol.1), 1958 (vol.2) and Walker, EW and Philip S.Corbet, 1975 (vol 3). The odonata of Canada and Alaska, U. Toronto P., Canada.

Westfall, Minter J.,Jr. and M.L.May 1996. Damselflies of N.America, Sci.Publ., Gainesville, Fla.. 649 pp..

(as the title and authors suggest, this is the court of last recall, currently, for anyone working seriously with zygoptera. It has exc. keys, descriptions, and B&W photographs of the genitalia and mesostigmal plates of essentially all N.American species. In addition it has an absolutely scholarly account of zygopteran biology).

Appendix IA -IE Generalized routes followed on the Guthrie-Bancroft and the Pierce farms during 1999 (see the following topographic sheets).

A-G-B on 11th June-note ; location of the woodland swamp/marsh, the small pond in the Guthrie field, and the dogbane patch, all described in the text.
B-G-B on 5th July
C-G-B on 31 July
D-G-B on 27 Aug.
E-Pierce farm-on 31 July

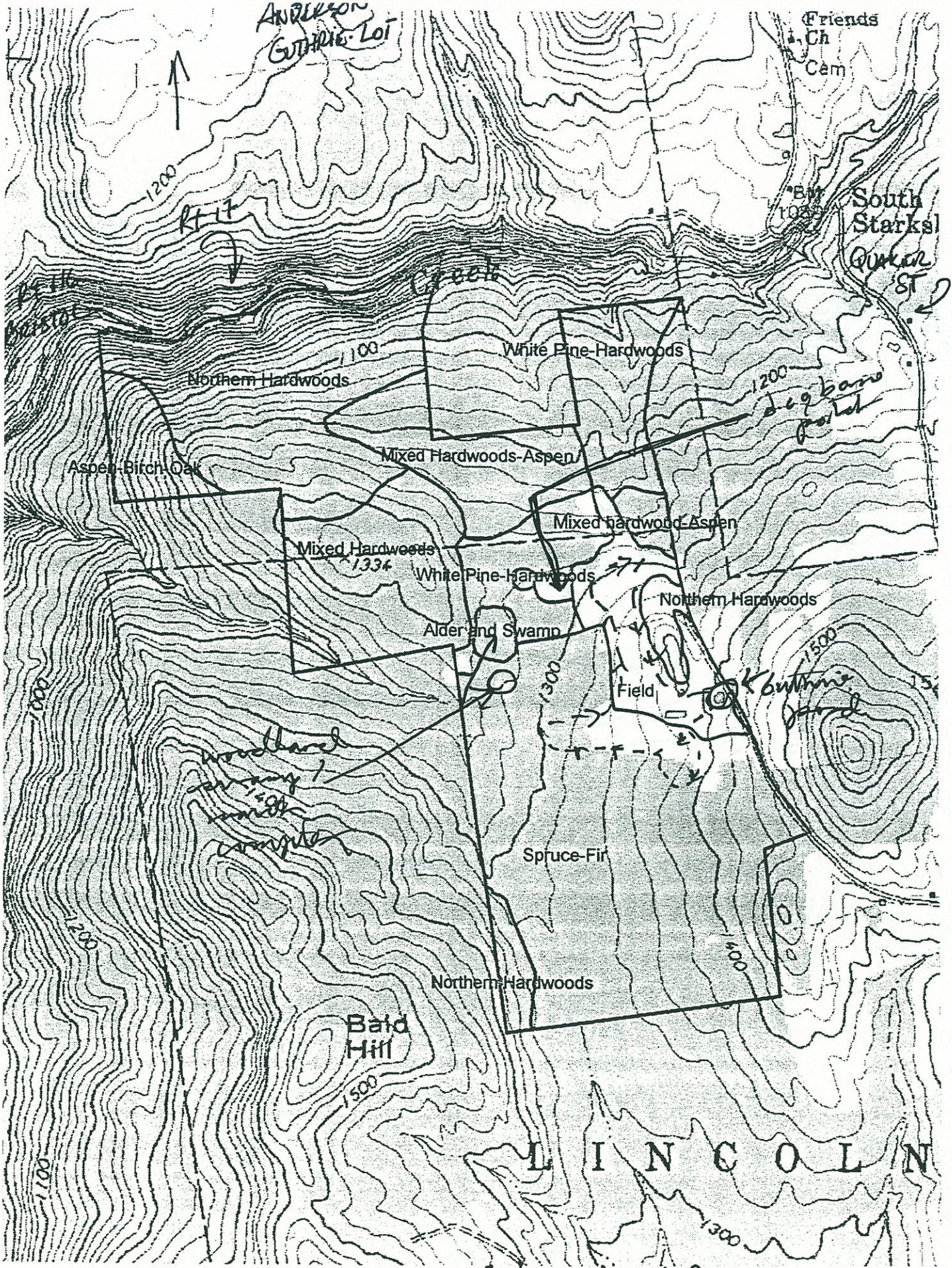
I had no suitable map of the Wells property. However, the routes I followed when sampling at this property were generally the same, to wit:

5 July- field and swamp to the south and east of the homestead than east to just beyond the top of the height of land and than back across the field to the east. At this time the field was quite wet, even though it had been quite dry.

27 August- as above but well beyond the height of land downhill east to the wooded valley below. I saw no boundary markers here. Then, back to the field and westward across to the field into the swamp/marsh at the nw corner of the field.

At this date the field was quite dry and the small man-made pond nw of the house was almost empty.

Despite all the routes I followed through the various woodlands, very few butterflies or odonates were recorded in any woodland proper, as compared to clearings in the woodlands. The only butterflies that occurred in woodlands "regularly" were: the Canadian S., the N. Pearly Eye, the Mourning Cloak and the Mustard White. The Atlantis F. was regularly seen along some of the woodland trails. I had, however, only one record each of the Mourning Cloak and the Mustard White, both known to be classic woodland dwelling species.



Anderson
Guthrie Lot

Friends
Ch
Cam

South
Starks
Quaker
St

dig bare
patch

K Guthrie

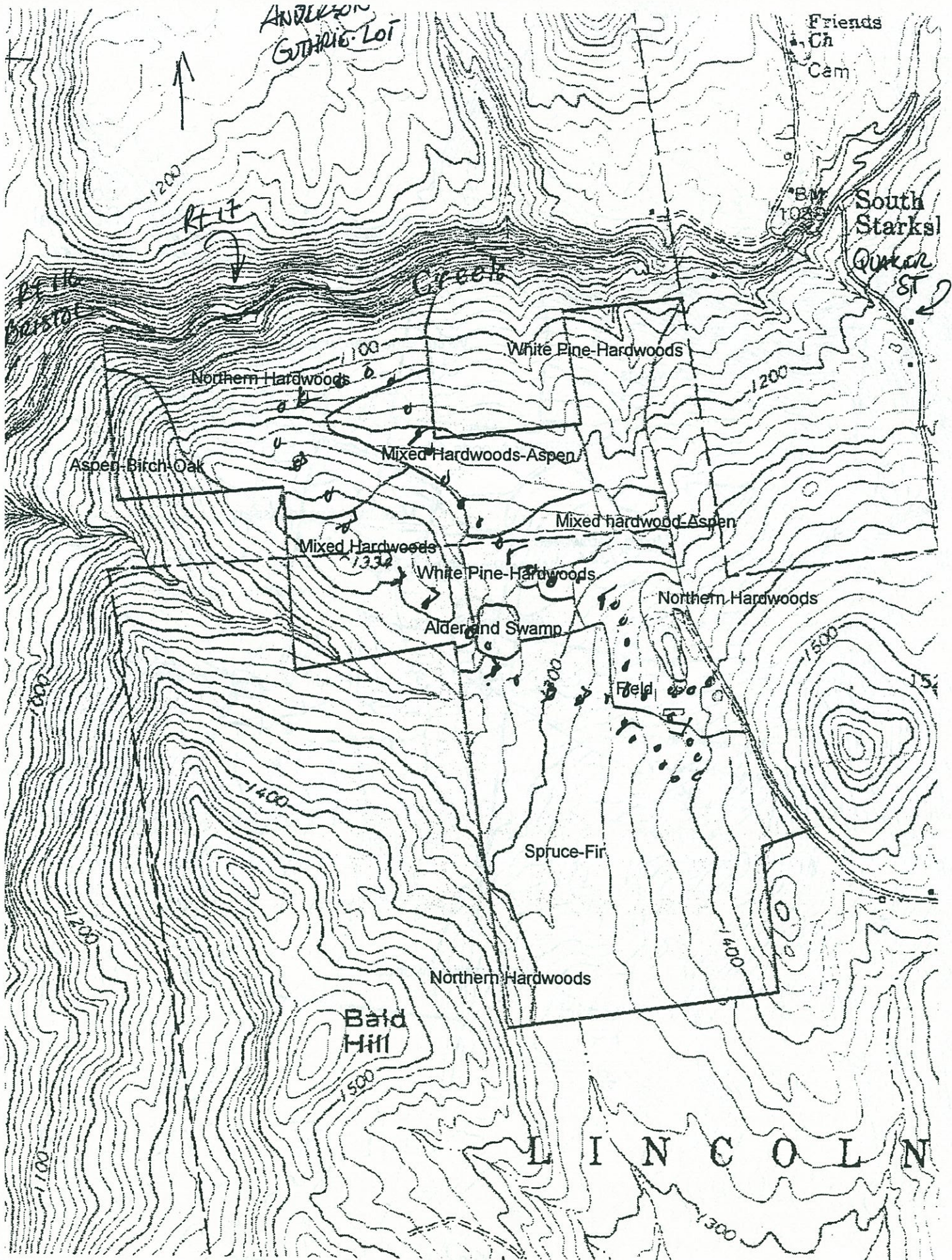
woodland
spruce fir
conifers

Bald
Hill

L I N C O L N

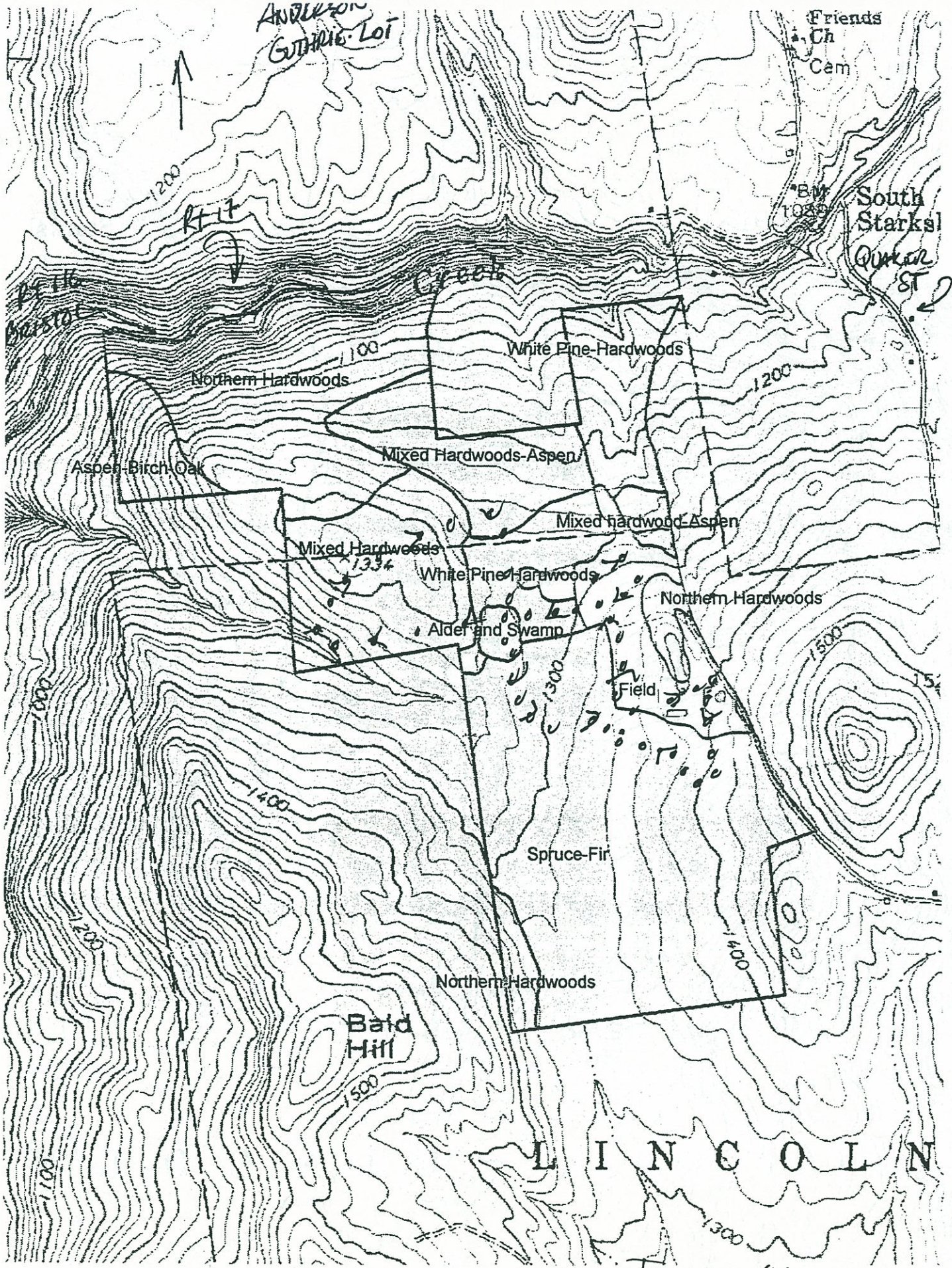
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A



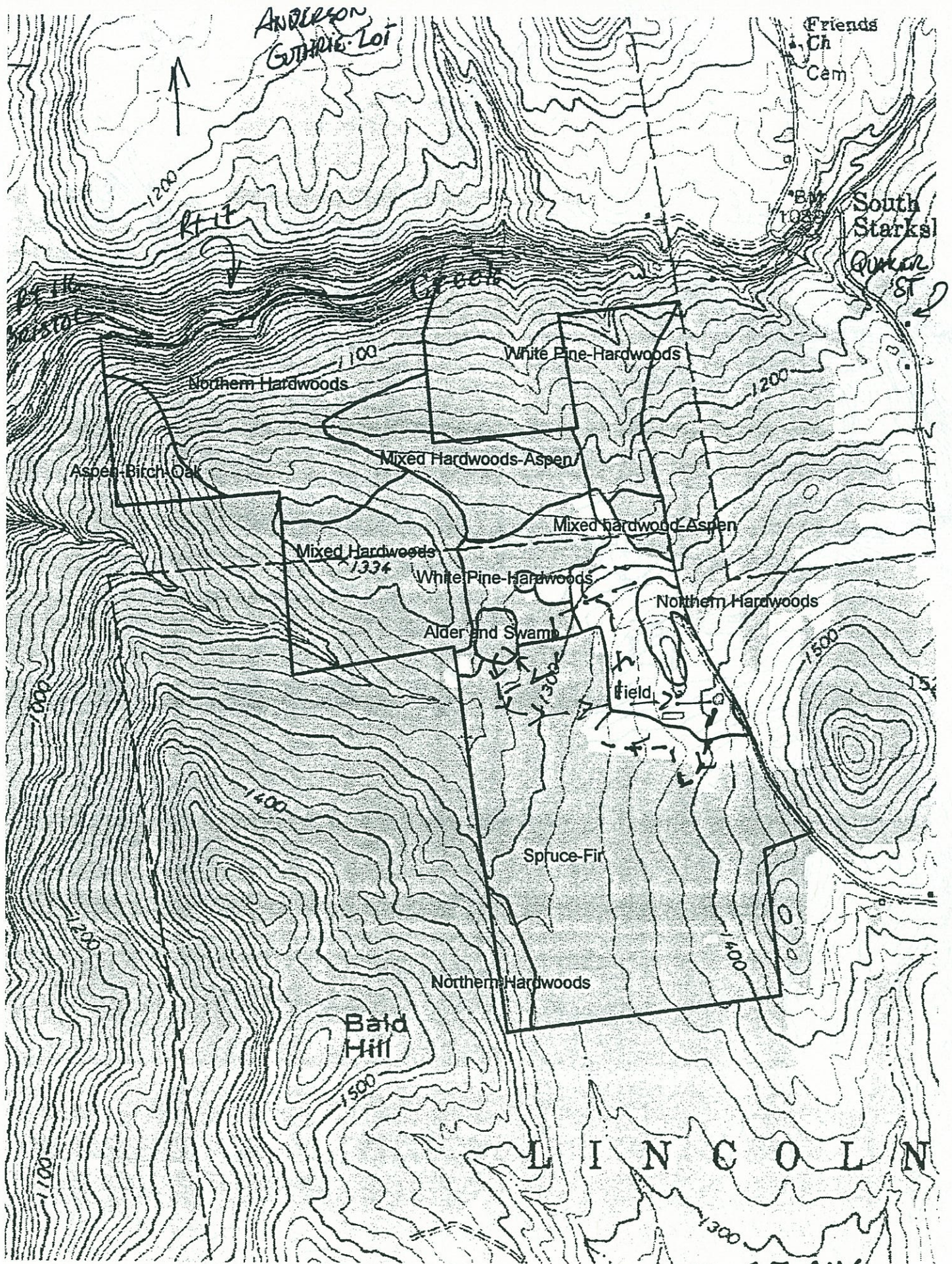
B

0.000 route 5 vii



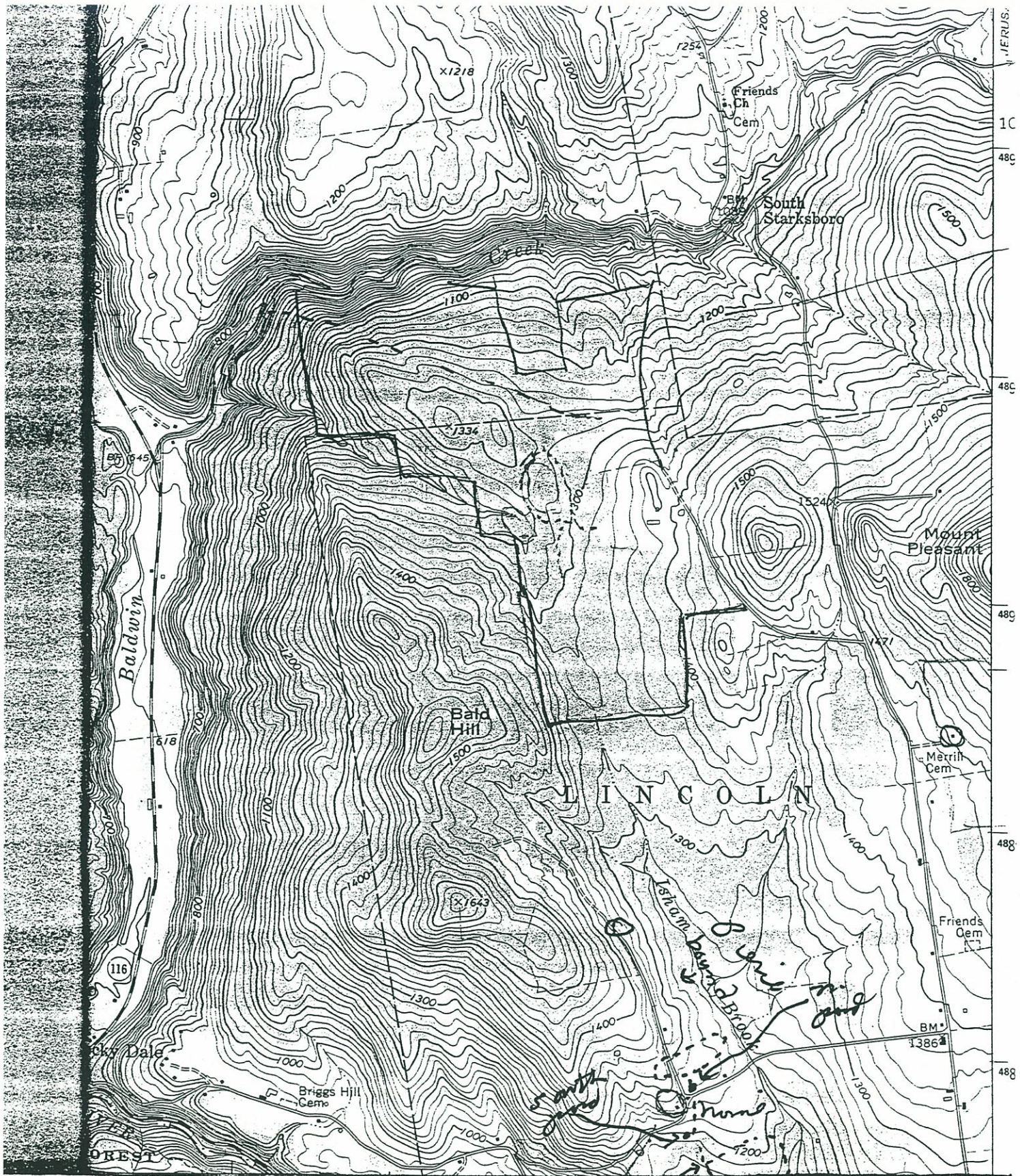
C

0 0 0 0 route 31 V11



D

--- route 27 Av. 6.



E

Perry Farm -
31 July 1999

..... route

marsh

brock

