Rates of Harvest and Compliance with Regulations in Natural Populations of American Ginseng (Panax quinquefoliusL.)

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Rates of Harvest and Compliance with Regulations in Natural Populations of American Ginseng (*Panax quinquefolius* L.)

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ABSTRACT: Thirty natural populations of American ginseng (*Panax quinquefolius* L.) were censused twice annually for five to 11 years to monitor the rate, frequency, and intensity of root harvest. Over this period, 43% of populations were harvested and ca.10% of plants was removed by harvesters. On an annual basis, 15% of populations were harvested and 1.3% of individuals were confirmed harvested. Both rates are likely underestimates of actual rates since we used conservative criteria to recognize harvest. Nearly half of the harvested populations were harvested more than once. Harvesters removed a small proportion of plants from populations; however, they frequently took non-reproductive and small plants, making the effect of harvest more destructive. In addition, violations of regulations regarding season, location, and plant size were common (20%, 65%, and 82% of events, respectively). Only 6% of harvest events were legal and 1.4% of plants were legally harvested in all three respects at the study sites. Two illegal harvests were documented carefully because they occurred at or near census points. These harvests highlighted the proximal factors that result in unsustainable harvest practices: (1) removal of adult plants prior to ripening of seeds, thus precluding the proper planting of propagules for population recovery; (2) removal of plants that are under the legal size limit, with no ability of dealers or buyers to detect this violation; and (3) removal of plants from land in which harvest is strictly prohibited, and the associated difficulty of enforcing such rules. We discuss policy options that could contribute to addressing these problems.

Index terms: ginseng, harvest, *Panax quinquefolius*, regulations, sustainability

INTRODUCTION

American ginseng (*Panax quinquefolius* L.) is America's premier wild-harvested medicinal plant species (Robbins 1998). Revered in Asian cultures in traditional medicine, the wild root is believed to be more potent than cultivated roots, and thus commands a significantly higher price. Market demand has driven the wild harvest of ginseng for nearly three centuries (Catling et al. 1994; Taylor 2006). Concern about the sustainability of harvesting led to the listing of ginseng on Appendix II of CITES in 1975 and implementation of state-based regulation of ginseng harvest with oversight by the U.S. Fish and Wildlife Service (USFWS; Robbins 2000). An insightful analysis of the management program set up by the USFWS identified several shortcomings with respect to the goal of ginseng conservation, including lack of funding of the state mandate, which in turn leads to a dearth of ecological information about the status of wild populations (Robbins 2000).

Despite the lack of widespread monitoring of ginseng populations, such as that which routinely occurs for other harvested species such as fish and game, two classes of studies have attempted to document the impact of harvest on ginseng. In the first type of study, populations were harvested, and recovery followed for several years thereafter (Lewis 1988; Van der Voort et al. 2003). These studies showed that numerical recovery had not occurred, even several years after the original event (5 y in Missouri, 11 y in West Virginia), although both populations were re-establishing reproductive capacity. In the second class of studies, detailed demographic studies were carried out (Charron and Gagnon 1991; Nantel et al. 1996; McGraw and Furedi 2005; Van der Voort and McGraw 2006; Farrington et al. 2009) and most of these explicitly evaluated harvest effects. Simulations of harvests have concluded that low rates of harvest (1% to 8%) may be sustainable if performed optimally (Charron and Gagnon 1991; Nantel et al. 1996). However, model simulations suggested that simply 'complying' with regulations was not sufficient to ensure sustainable harvests (Van der Voort and McGraw 2006): rather, only stewardship behavior on the part of harvesters was sufficient to preserve long-term population recovery and growth. Farrington et al. (2009) have taken the analysis one step further, noting that the net effect of harvest depended on the level of browsing by white-tailed deer (*Odocoileus virginianus* Zimm.). None of the preceding studies documented the frequencies of different kinds of harvest events in natural populations, but merely the consequences of alternative scenarios. Therefore, despite the power of the detailed demographic studies and simulations to answer 'what if' questions, the elephantine question in the ginseng management room

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is "how do ginseng harvesters *actually* behave?"

A second critical unknown in ginseng management involves the rate of harvest relative to the size of the resource. Harvester behavior may matter very little if a miniscule fraction of populations and plants are harvested annually. Unfortunately, due to the secretive culture of harvest and the lack of a widespread monitoring program, harvest rate and frequency data are difficult to obtain. Instead, the USFWS relies primarily on trends in total harvest as an indicator of changes in the size of the resource, a strategy that assumes constant harvester numbers and pressure. Bailey (1999) demonstrated that harvest quantity tracked unemployment, however, suggesting that economic forces could, at a minimum, complicate if not invalidate such a facile approach. One study quasi-randomly sampled the landscape for ginseng to obtain density estimates for West Virginia, then knowing harvest for that state (as well as roots/kg), a crude harvest rate of 4.9% was estimated (McGraw et al. 2003). This number was acknowledged to have large error bars due to sampling issues associated with estimating densities over such a large geographic area.

Long-term censusing of 30 populations for demographic studies has yielded a unique opportunity to employ a third approach to assessing critical attributes of harvest in natural ginseng populations; namely, assembling statistics from direct and indirect observation of harvest in cryptically marked populations over several years. Specifically, we addressed the following questions: (1) what percent of natural populations and individuals within those populations are harvested?; (2) how frequently are populations harvested?; (3) how 'intensive' is the harvest?; and (4) to what degree are harvest events 'legal' in the sense of complying with regulations regarding seasons, plant sizes, and locations? In addition, we made detailed observations of two separate illegal harvests in Kentucky that occurred close to our annual fall census, permitting us to document the events in unusual detail.

METHODS

The Populations

We began formal censusing of natural ginseng populations in 1998. From 2000 onward, additional populations were added to the census, such that by 2004, we were censusing 30 populations twice each year. Obtaining a truly random sample of ginseng populations was not practical. Ginseng populations are found only sporadically in the eastern deciduous forest and large amounts of time are required to locate new populations in a completely random fashion. Therefore, our survey populations were located by a combination of random sampling and personal contacts with landowners, managers of private or public lands, state ginseng program managers, state natural resource personnel, or national forest/park personnel. When deciding to pursue censusing, we did so only if the contact person was not known to actively harvest ginseng themselves and the population was considered 'natural' (i.e., not planted). With no well-tested genetic markers for wild versus cultivated genotypes, we were not able to confirm definitively the genetic origin of our populations; however, after several years it remained clear that none of the populations was being actively managed. In addition, we purposely selected populations to census that covered a range of land use types, which we classified into five groups: (1) military bases (three populations), to represent the least harvested end of the spectrum; as close to 'no harvest' controls as possible; (2) national forests, wilderness, and parks, representing large tracts of publicly accessible land (six populations); (3) private land (14 populations); (4) publicly accessible, nongovernmental nature preserves (four populations); and (5) state parks and forests (three populations). These 30 populations were dispersed across seven states: New York (two), Pennsylvania (two), Maryland (one), Indiana (two), Kentucky (six), Virginia (five), and West Virginia (12). They ranged in elevation from ca. 100 m to 1000 m asl, and from 37° to 43° latitude (Wixted and McGraw 2009). Further location details are withheld because of conservation concerns.

Among the 30 populations, the number of seasons of data varied between five and 11, for a total of 221 'population-years'. The number of plants censused gradually increased over time as populations were added and additional individuals were discovered; in 2008, 4552 individuals were censused. Populations varied in size from a low of seven to a high of 485 individuals with a mean of 130. Over the entire study, 28,688 plant observations were made and 31,871 seeds were counted.

Census Procedure

Every year, each population was censused twice, once in the spring (between 15 May and 15 June) and once in the fall (between 1 August and 10 September). Every plant was marked with a subterranean nail bearing a unique identifying number. Plants were relocated using a phototrail consisting of landmark points, azimuths, and distances accompanied by digital photographs taken at multiple distances from each plant. This procedure ensured that plants would be apparent or hidden from harvester view to the same degree as unmarked plants.

Criteria for Harvest

A plant was identified as 'harvested' in either the spring or fall census using conservative criteria. If (a) the plant was missing, (b) there was evidence of digging (a hole or loose soil where the root should have been), and (c) the root was absent, then the plant was labeled tentatively as harvested. Supplemental evidence for harvest sometimes found at the site included discarded tops and a prevalence of other similar missing plants (harvesters rarely remove just one plant). Finally, a harvest was confirmed the following year if the plant remained missing. Factors other than harvest can cause plants to disappear. For example, deer can browse the plants; however, deer remove only the sympodium and leaves, leaving the root intact (McGraw and Furedi 2005; Farrington et al. 2009). Most plants will grow a new set of leaves in the year following browse. Infrequently, plants become severely infected and killed by fungal diseases, but in these cases the root is still present, though it may be partially decayed. Because data from the spring census were required to confirm harvest, the 2008 year was excluded from the analysis of harvest incidence as the data were incomplete; however, early harvests discovered in the fall 2008 census were used to document the intensity of harvest as well as the incidence of illegal harvest.

Legality of Harvest

If a plant was determined to be 'harvested' while carrying out the spring census (and later confirmed through continued absence), we assumed that the plant was harvested legally during the harvest season, after the previous fall census. Most of our fall censuses occurred 0 to 3 wk before the onset of the harvest season in a given state; we erred on the side of assuming the harvest occurred at a legal date, as long as it occurred after our census. In fact, a few harvests we termed 'legal' in terms of season may have occurred illegally between our census date and the onset of the harvest season. If a plant was determined to be 'harvested' during the fall census (but was present earlier that same calendar year in the spring), we checked the fall census date – as long as that date was prior to the legal season start date, we deemed that harvest 'illegal' with respect to season.

Since most states require plants to have three 'prongs' (leaves) or more upon harvest, we termed a harvest event as 'illegal' with respect to size if any of the plants had one or two prongs when harvested. Finally, with respect to location of the harvest, we referred to the relevant state and federal laws to determine whether harvest would be legal on the property. Any harvest on private land was considered legal, even though some states require written permission to harvest from private land; we were not able to determine whether or not permission had been granted with certainty.

Case Studies

Two illegal harvests on nature preserves occurred in close proximity to our fall census (one was observed directly, and occurred on the same day). We took advantage of these events to analyze in detail the precise nature of the harvest in terms of sizes of plants taken, whether or not plants were reproductive, and if so, whether the berries were ripe.

Statistical Analysis

The answers to the primary questions posed in this study required simple manipulations of the original data set (e.g., summing harvested plants across all observations in each population in each year). In addition, summaries by land use type and by type of harvest statute violation were simple meta-analyses of the large census data set. To determine whether harvest incidence varied among land-use types, we used a loglikelihood analysis (G-test) to determine whether the proportion of years in which harvest occurred varied among land-use categories, pooling across populations within those categories. To test whether harvest incidence varied as a function of population size, we performed logistic regression. All statistical analyses were performed with SAS JMP v. 7.0 with significance set at $P < 0.05$.

RESULTS

Harvest Rate

Over the five to 11 year period of the study, 13 of the 30 populations (43%) were harvested at least once. Of the seven states, only Pennsylvania (with only two study populations, one of which was well-protected) did not have harvested populations during the study period. There was no clear geographic pattern: western, southern, central, and northern populations experienced harvest, as well as low and high elevation populations. In the 221 observed 'population-years', 34 harvest events occurred, suggesting an annual probability that a population will experience harvest of 15.4%.

A total of 368 plants were confirmed harvested over the time frame of the study (the mean observation period/plant was 7.4 y). An average of 3877 plants was observed in each of those seasons, yielding a harvest rate for the study period of 9.5%. Annualized, this suggests a relatively low risk of harvest of ca. 1.3%. Note that this figure includes plants of all sizes, but the harvest is concentrated in the adults (but see below); thus, the harvest rate of the adult portion of the population would be higher than this. Confining the plant harvest rate to only harvested populations, the removal rate was still a modest 7.3% of the total plant population.

Harvest events occurred most frequently on nature preserves and state parks/ forests (> 40% of population-years), with intermediate levels on private land (ca. 16%), and none observed on military bases or in national forests/parks/wilderness (Figure 1a). Harvest probability increased as population size increased (as measured by logistic regression) from ca. 10% for the smallest populations to 50% for the largest populations (Figure 1b).

Harvest Frequency

The distribution of harvest frequencies was bimodal. Seven of the 13 populations where harvest was observed experienced harvest only once during the study period (Figure 2). Five other populations experienced harvests in about half of the observation years, while one outlier population experienced harvest every year (Figure 2). The latter population was in a 'protected' nature preserve and one of the harvest events in that population is described below in more detail (Case Study 2).

Harvest Intensity

There are many components of harvest intensity and, therefore, alternative ways of measuring it. We used three measures: (1) the proportion of plants in the population that were harvested; (2) the proportion of harvested plants that were non-reproductive; and (3) the proportion of harvested plants that were under the size limit. The first of these was reported above. The second and third are measures of intensity because harvest guidelines in most states strongly suggest that only seed-bearing plants be harvested and that plants must be 3-leaved or larger; the degree to which

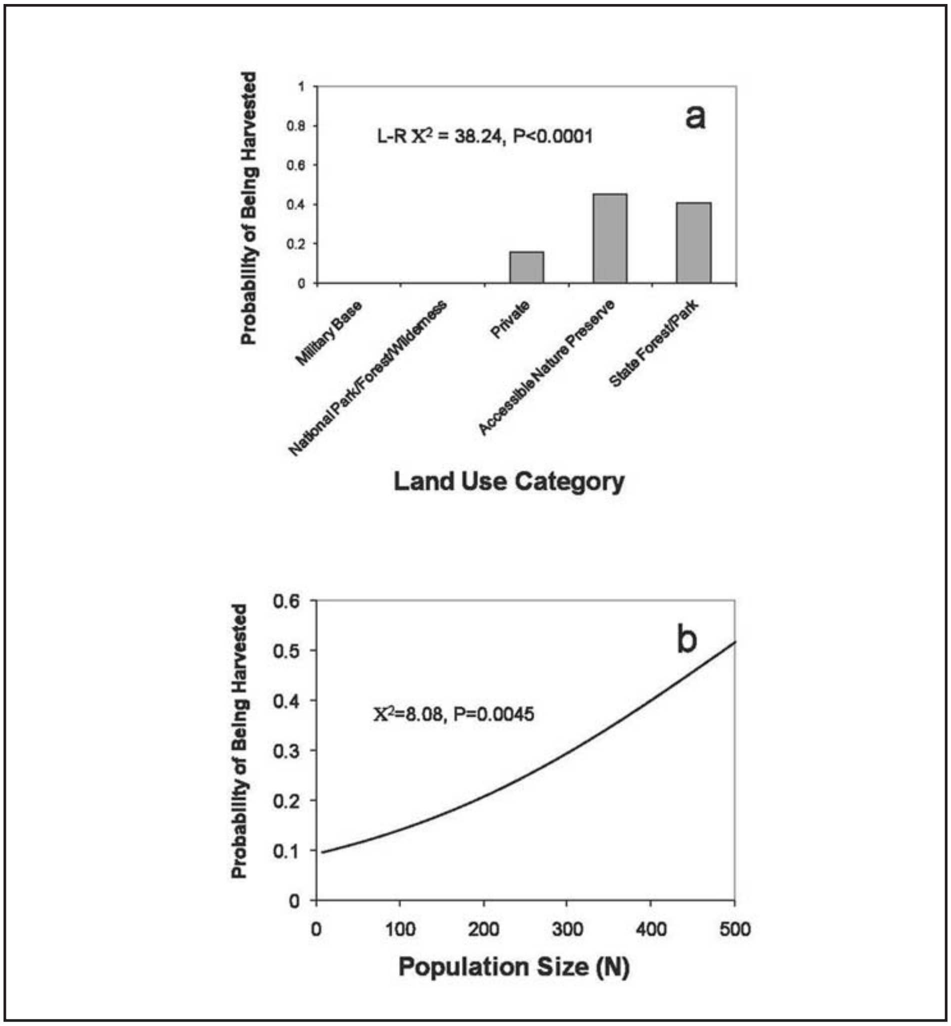

Figure 1. Incidence of ginseng harvest, expressed as a probability, as a function of (a) property class (G-test; test statistic is the Likelihood-Ratio X^2, $P < 0.05$), and (b) population size (logistic regression; test statistic is X^2 $P < 0.05$).

harvesters ignore these practices represents an indirect measure of harvest intensity.

As shown above, by the first measure (percent of plants removed), harvest intensity was low. However, by the second and third criteria, intensity was high. Despite harvest guidelines, 69% of the harvested plants had no seeds in the year of harvest (Figure 3a). In addition, undersized plants were frequently harvested; 37% of all harvested plants were one- or two-leaved plants (Figure 3b).

Illegal Harvest

Most harvests observed in the study populations were illegal in one sense or another. Of the three measures of illegal harvest, noncompliance with harvest seasons (underestimated here) was the lowest, yet 21% of harvest events occurred out-of-season. Well-guarded populations, such as those on military bases, were not harvested, but populations found on open-access lands where harvesting was prohibited by law (e.g., state parks and nature preserves) were particularly vulnerable; 65% of observed harvest events were on such lands. Size limits were routinely ignored by harvesters, and though 63% of harvested plants were of legal size (Figure 3b), in 82% of documented harvest events, some undersized plants were harvested. Considering all legal criteria jointly, only 5.9% of harvests were legal in all three respects (94.1% illegal) and in those legal harvests, only five plants were harvested (out of 368 total; 1.4%).

Case Study 1: Illegal Harvest of a Kentucky Nature Preserve

A large population of 368 plants was censused on 22 August 2008. The census was interrupted by clanging tools on rocks ca. 40 m from the field crew, just out of sight over a knoll. The harvest proceeded for approximately 20 minutes, then two individuals walked slowly by the field crew on a nearby path, one carrying a digging tool, the other a partially filled sack. After a brief discussion of the weather with the field crew, the two harvesters moved on down the trail. From the discussion, it was clear that the harvesters had entered the

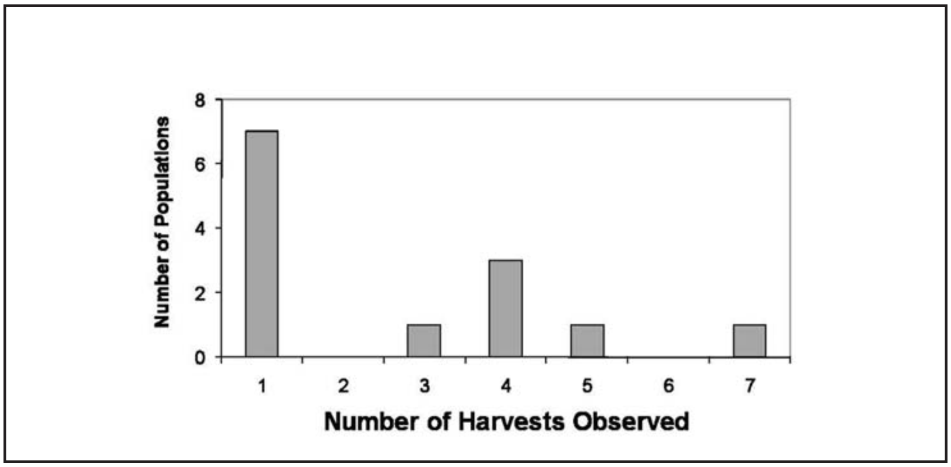

Figure 2. Frequency of ginseng harvests in the 13 populations that were harvested over the course of the study.

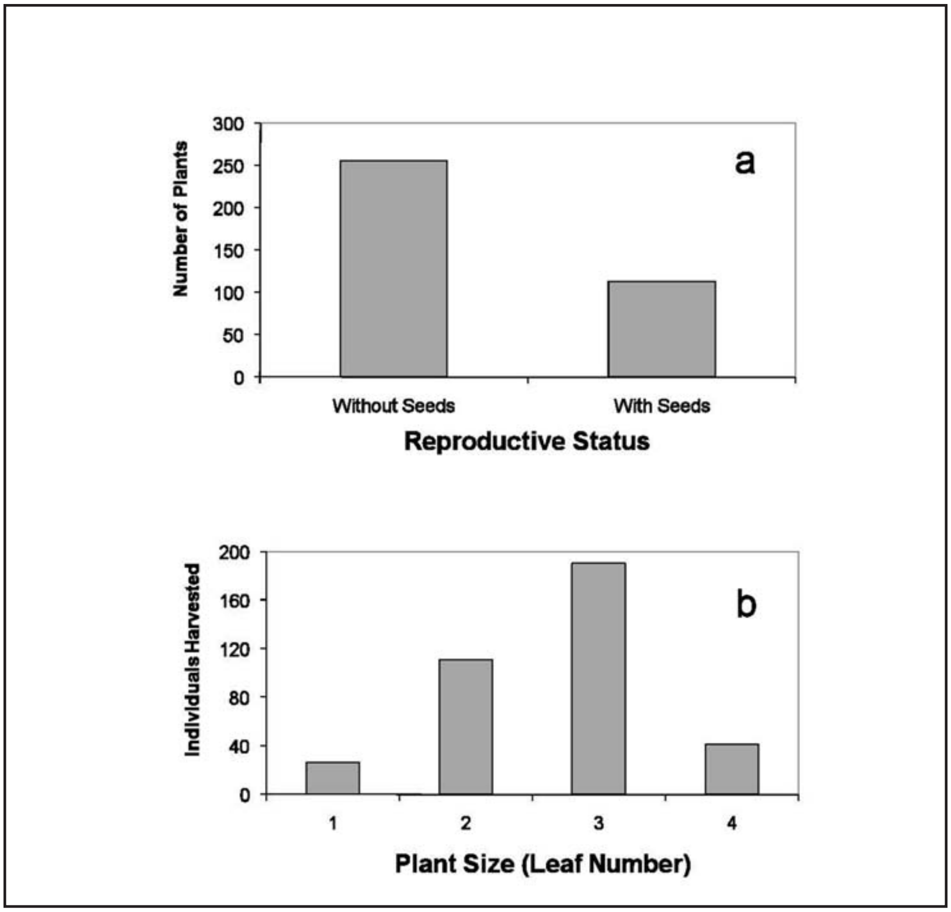

Figure 3. Intensity of ginseng harvest across the 30 study populations as measured by (a) number of non-reproductive and reproductive plants removed, and (b) size distribution of harvested plants.

preserve at a point distant from the parking lot and public entrance. The census crew very likely inhibited continued harvest of the population, but it was clear that the harvesters were unaware of their presence prior to the conversation – thus, we assume the plants taken were representative of the typical actions of these two individuals. The harvesters removed plants primarily from two large, dense clusters of individuals containing many large plants and a mix of seedlings and juveniles as well. The harvest was legal in terms of the date (the season in Kentucky began on 15 August in 2008); however, the harvest was illegal because the nature preserve expressly prohibits harvesting, and a few undersized plants were removed.

A comparison of size discrimination between this harvest event and others is difficult because in other cases we do not know what plants were seen by the harvester but left behind on purpose. In this case, because all the plants were in a tight cluster, we know that the harvest of undersized plants was relatively low (15% of all those harvested; Figure 4a) – a number that is less than that of the average seen over all harvesters (Figure 3b). We also know that the majority of the small roots were obviously seen but left alone (95% of all plants with one or two leaves were left in place), while the roots from large plants were mostly removed; 71% of all plants with three leaves or more were taken. Moreover, a large portion (75%) of harvested plants were reproductive (i.e., they were developing seeds) (Figure 4b). We counted 270 seeds on the discarded tops, representing more than 60% of the reproductive output of the entire population. The vast majority (94%) of these seeds were found in small, green (i.e., unripe) berries (Figure 4c). Tops, including leaves and infructescences, were discarded on the soil surface and no attempt was made to plant the seeds. In total, 48 roots were harvested (13% of the plants in the population; 23% of the plants in the clusters where they were found).

Case Study 2: Illegal Harvest from a Second Kentucky Nature Preserve

The second case of harvesting was detected on 25 July 2006 in a population of 267 plants. The field crew found loose soil and scattered nails where plants previously measured during the June census had been. Numerous large plants near the censused population had also been dug. The observation of a footprint, when the area had experienced heavy rains only two days before, indicated that the harvest was recent. This harvest was illegal on three counts: location, removal of undersized plants, and date, which was well before the start of the Kentucky harvest season (15 August).

In this case, the percent of harvested plants which were undersized (23%) was closer to the average, but an even smaller percent (3%) were non-reproductive (Figure 5 a,b). Plants in this population were more robust than those in the first case study, so that two-leaved plants were more likely to be noticed as well as to be reproductive. The percent of plants taken from a given size class was 13%, 38%, and 26%, respectively, for two-, three-, and four-leaved plants (Figure 5c). Eleven percent of the total population was harvested.

We estimated the loss of reproductive output to the population in two ways. Based on the discarded tops of 17 of the 30 harvested plants, 134 seeds or 18% of the population seed output was lost. This is likely to be a large underestimate, not only because we did not recover all of the tops, but because most immature (and thus uncounted) seeds would have matured if the plants had been allowed to survive. Although we did not note the color of the fruits, at this population, plants typically had some red fruits by this date along with many small green ones, the relative proportions varying greatly among plants. There was no evidence any seeds were planted.

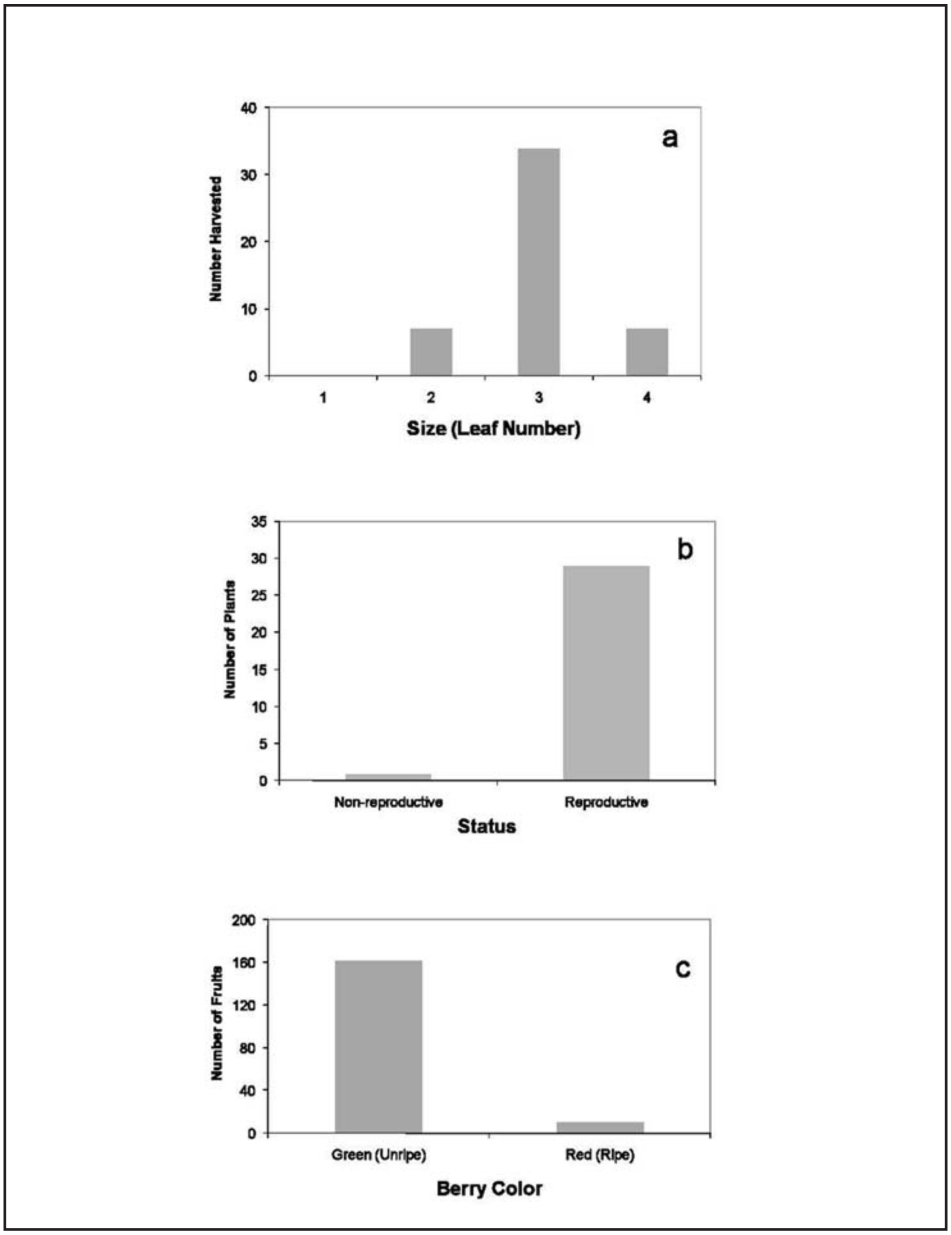

Figure 4. Summary statistics on harvested ginseng plants in Case Study 1, including (a) size distribution, (b) reproductive status, and (c) berry ripening phase on the date of harvest.

Our second approach was to estimate what the seed production might have been, given the number of flowers produced by the harvested plants and the mean seed to flower ratio for the non-harvested plants of different size classes at this site. This leads to an estimate of 264 seeds lost due to harvest.

DISCUSSION

The previously published ‘crude’ harvest rate estimate of 4.9% (McGraw et al. 2003) was calculated from the annual harvest in a defined area (West Virginia; ~4.3 million plants per y) divided by the estimated total number of plants in the state (87.8 million; determined by quasi-random transect surveys of forested land). These large numbers for both harvest and total numbers suggest an unusual kind of rarity – a species with hundreds of thousands to millions of small populations. The present study is the first to estimate what fraction of these populations may be harvested annually (ca. 15%) or, over a longer period (ca. 7 y), how many would be expected to be harvested at least once (43%). Underlying these important statistics is the assumption that these populations are truly representative of the metapopulation of ginseng across its range. Geographically, we believe the censused populations are a relatively good representation, although the southern portion of the range (including Missouri, Tennessee, and North Carolina) is under-represented. In terms of land use, private property is under-sampled relative to its prevalence across the eastern deciduous forest, but harvest rates were intermediate on private land, so adjusting for this would probably not change estimates significantly. More serious is the over-representation of nature preserves and state parks in the data set, which had high rates of harvest, but this was balanced somewhat by inclusion of military bases, which were even more over-represented and had harvest rates of zero.

Tempering our estimates of harvest rate were two further considerations: (1) the conservative criteria we used for recognizing harvest; and (2) the inhibitory effect our censusing may have had on harvest. Using our criteria, we undoubtedly concluded that certain plants died but did not recognize that harvest was the cause as the harvest was disguised. This would reduce estimates of both the percent of plants and possibly also the percent of populations harvested. We know that in at least one case (Case Study 1), our presence likely inhibited harvest. However, we also know that diggers routinely uncovered our plant-identifying subterranean nails during their harvest activities – this could have inhibited some harvesters from further digging activities. Less likely, but also possible for individual cases, the discovery of a marked population could have stimulated further searching and digging. We simply have no way of knowing how harvesters would respond to this knowledge, but the calculated rates contain the inherent assumption that there was no effect. We believe the net effect of all assumptions underlying the harvest statistics is likely to mean that the figures presented are underestimates of true rates. Thus, the interpretation that harvest rates of natural ginseng populations are low should be viewed with a great deal of caution.

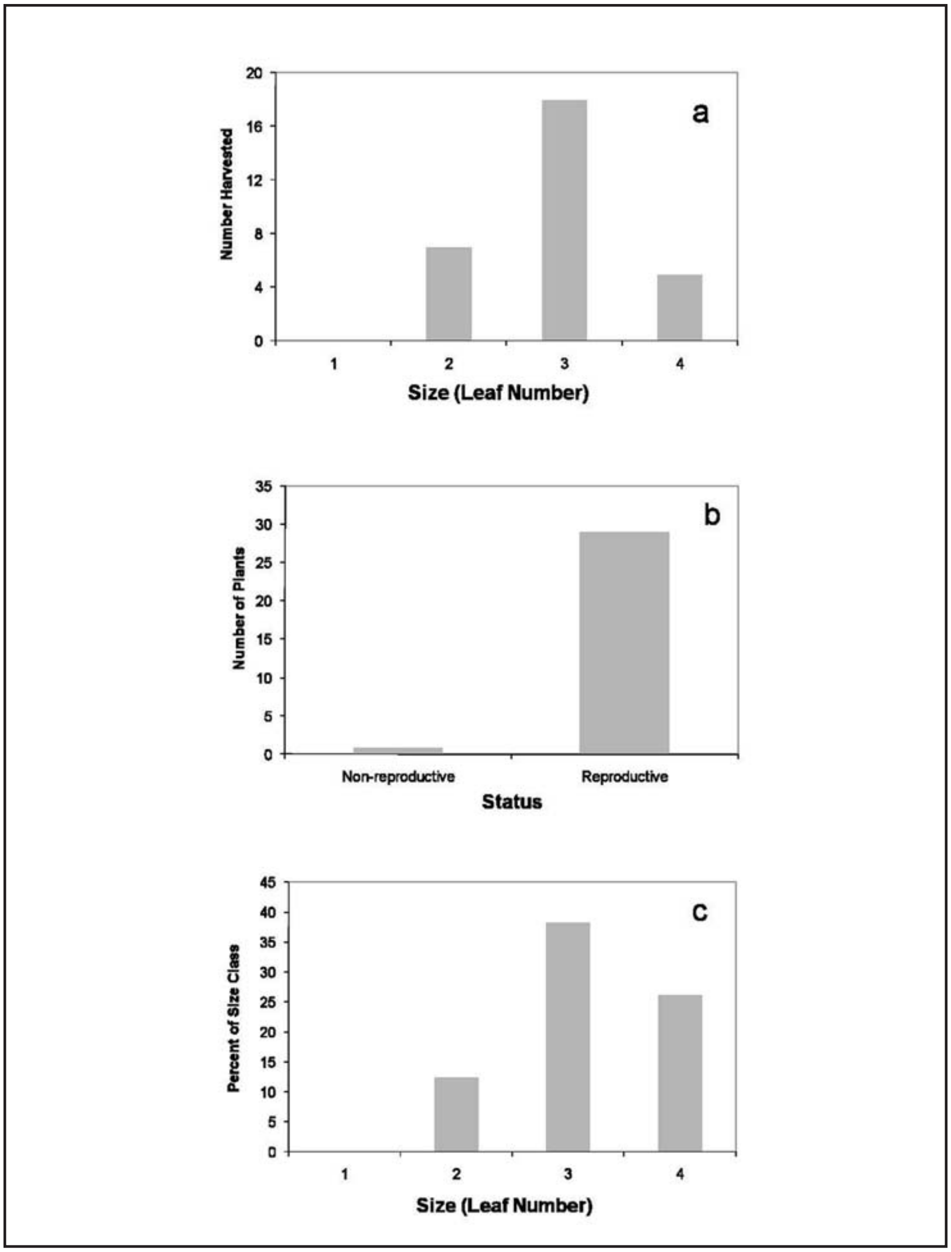

Figure 5. Summary statistics on harvested ginseng plants in Case Study 2, including (a) size distribution and (b) reproductive status.

With respect to harvest 'intensity' and compliance with regulations, our findings suggest that harvesters are generally not acting in a stewardship fashion (sensu, Van der Voort and McGraw 2006) in the harvest events we observed. The harvest of non-reproductive and small plants occurred frequently. While compliance with seasons was relatively good, a 21% violation rate suggests that ample motivation remains for some harvesters to ignore these regulations. One such motivation for all of these poor practices is pre-emptive competition among harvesters for what is perceived to be a limited resource – a 'tragedy of the commons' (Hardin 1968; Mace and Reynolds 2001). The temptation to harvest early must be strong since it is obvious that seeds are not ripe and, therefore, the harvest is more destructive than later harvest. Demographic simulation modeling has shown the destructive consequences of early harvest (Van der Voort and McGraw 2006). Therefore, management actions to reduce this behavior and encourage stewardship behavior are especially important.

Harvest events occurring on property where it is strictly prohibited present a particularly vexing aspect of managing for widely-dispersed, valuable species such as ginseng. Unlike game hunting, ginseng digging can be performed relatively quietly and go unnoticed. Unlike fishing, which is concentrated in a confined area at the water's edge (at least in freshwater ponds, small lakes, and rivers), ginseng harvesters can range widely and enter a tract of land from many angles. Tools and harvested roots can be hidden from view. In documenting 22 harvest events on private preserves and state forests/parks, none of the violators was caught. Indeed, in no case were the managers of the property aware that harvests had occurred. Clearly, the lack of consequences for violating ginseng harvest regulations is a serious shortcoming of current policies. In addition, dealers who buy roots have no mechanism for verifying that the harvest occurred legally with respect to location.

Violation of size restrictions (plants must be three-leaved or larger) represents another component of ginseng management that is undetectable with present rules. The high frequency of illegal harvest events with respect to size suggests that harvesters can do this calculus readily, and know they will not suffer for it. More disturbing is the evident willingness of diggers to violate this rule, suggesting either that they do not understand the reason for the rule or that violation of regulations is so commonplace that it is accepted culturally. Education of the harvester may help in this regard, but competition among harvesters may spur continued transgressions. In this component of ginseng management, there is a strong need for a verifiable point-of-sale size requirement. The state of Wisconsin has one mechanism to ensure compliance: they require harvesters to bring the sympodium with the reproductive structure (minus berries, which must be planted) to the point of sale as proof of plant size. Although the great majority of three-leaved plants produce flowers, the majority of them do not produce berries in any given year. Therefore, confirmation of leaf number does not ensure that a plant has produced sufficient offspring to replace itself. Moreover, in the central part of the range (Kentucky, Tennessee, W. Virginia), where a far greater number of plants are harvested, transporting large quantities of tops along with roots may be impractical for individual harvesters. Thus, alternative criteria to verify size should be considered. The relationship of root diameter to reproductive capacity could be determined, for example, as a way to develop a root size threshold for harvest. Due to the general size-dependency of plant demographic parameters (vis-à-vis age-specificity; Werner and Caswell 1977), almost any size criterion for harvest will be better than age, but it must be verifiable to be effective.

Ginseng age can be verified by counting bud scars on the rhizome; therefore, the USFWS has mandated a minimum age at harvest of five years. This age limit is supposed to ensure that plants have reached reproductive size before harvest, and appears to be based on previously published data from an extremely limited sample (Anderson et al. 1993). Our long-term data set allowed us to follow fates of a widely-distributed set (from 23 populations) of 519 newly-germinated seedlings (germinated 2003 or before) for five years in order to assess the true size and reproductive status of five-year old plants. The results (Figure 6) show that only 11 of 150 (7.3%) surviving seedlings had produced any seeds by age five. Furthermore, 139 of 150 (92.7%) five-year old plants still had only one or two leaves. Therefore, while age is verifiable, plants vary widely in size at any given age and age is a poor predictor of reproductive history. The depiction of plants aging and progressing rapidly and in lockstep through size classes (Anderson et al. 1993) is clearly misleading in its implication that age can be used as a proxy for size.

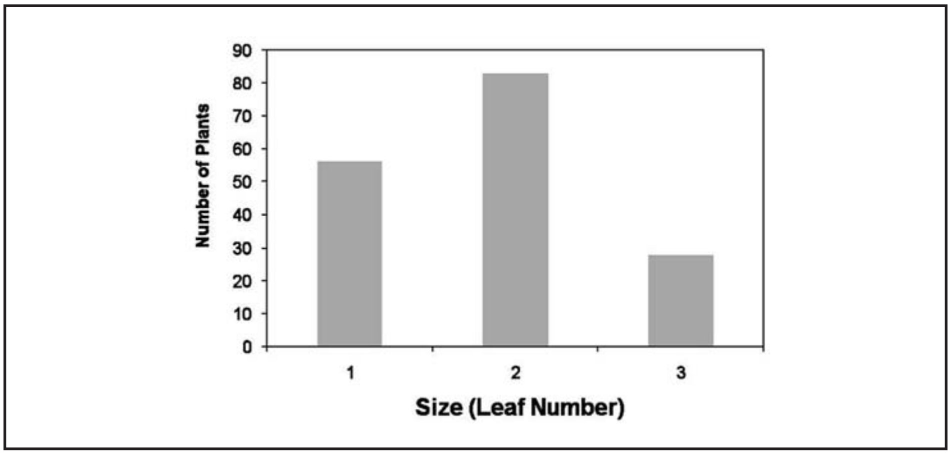

Figure 6. Size distribution of 150 surviving age five seedlings as determined by following fates of 519 new germinants observed in 23 populations in the period 1998 – 2003.

With its large propagule size, low seed number, and relatively high survival rates in the absence of harvest (Charron and Gagnon 1991), ginseng falls into a broad class of harvested species as diverse as elephants, gorillas, whales, and sharks, all of which have ‘slow’ life histories (Purvis 2001). Theoretical modeling suggests this type of life history places such species at higher risk of overexploitation (Purvis et al. 2000). In China, centuries of overharvesting, despite repeated governmental attempts to control it, have led to the virtual extirpation of wild Asian ginseng, *Panax ginseng* C.A. Mey (Taylor 2006), a species closely allied to *Panax quinquefolius* taxonomically, as well as in purported medicinal properties. A repeat of this historical trajectory seems likely in the United States, since harvest is driven by the same economic forces and similar mentality. A mitigating factor in this scenario, however, is the rapid increase in scientific understanding of the biology of natural populations of *Panax quinquefolius. Panax quinquefolius* exhibits size-dependent demography, shows consistent reproductive phenology through its range, and harvesters have the opportunity to contribute directly to population recovery via optimal seed planting. These traits all reinforce the need for: (1) synchronized, phenologically-based harvest seasons across all states that are permitted to have a ginseng program; (2) verifiable size limits to ensure reproduction and subsequent population recovery; (3) educational outreach to explain the scientific basis for new or existing regulations; and (4) stricter enforcement of the laws designed to discourage illegal harvest activities of all varieties.

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