

Tools and Methods for Data Collection in Ethnobotanical Studies of Homegardens

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Owners and managers of homegardens have extensive knowledge of plants, their uses, and ecosystemic processes. This knowledge might be highly valuable for many purposes. To enhance ethnobotanical research on homegardens and encourage a discussion of proper methodology, this article presents tools and methods used to collect data in the multidisciplinary study of homegardens in Chiapas, Mexico; Eastern Tyrol, Austria; and Kalimantan, Indonesia. The article defines homegardens and gardeners and explains both the sampling process used in these studies and how contact and rapport was established. Also discussed are possible research questions and hypotheses, equipment used in the field, interviewing strategies, vegetation surveys, and data management. Interviews typically elicit information on preferred garden plants, plant management, homegarden management, and the history of gardening in the study area. It is concluded that homegardens present an excellent opportunity to use and experiment with both informal and formal techniques to collect qualitative as well as quantitative data.

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Gardens are not only places for leisure and work but are becoming an important study area for ethnobotanists. The study of homegardens as distinct ecological and cultural entities in agriculture was initiated in the tropics of Southeast Asia and dates back about twenty-five years (see Soemarwoto 1975, 1987; Stoler 1975; Raintree 1978; Sommers 1978). Much ethnobotanical research on homegardens is still carried out among the indigenous peoples of the tropical developing world (see Millat-e-Mustafa 1996 for a review of homegarden research). This research has led to interesting results and new insights into the composition, management, and importance of these agroecosystems for subsistence and cash income, the application of tradi-

tional knowledge in community development, and the conservation of agrobiodiversity (Fernandes and Nair 1986; Padoch and De Jong 1991; Watson and Eyzaguirre 2002).

Less work has been conducted on homegardens in temperate climates. Given the obsession of many Europeans (especially the British) with gardening, the centuries-long history of many gardens in Europe, the current economic boom in the garden supply industry, and the extensive garden-related literature (on historical parks, botanical gardens, organic gardening, etc.), it is surprising that ethnobotanical research on homegardens is almost nonexistent in Europe and the United States (exceptions are Hauser 1976; Brun-Hool 1980; Lohmeyer 1983; Omohundro 1985; Poppendieck 1992; Inhetveen 1994; Agelet, Bonet, and Vallès 2000; Vogl-Lukasser and Vogl 2002; Wagner 2002).

We believe that this needs to change. Owners and managers of homegardens have extensive knowledge of plants, their uses, and ecosystemic processes. This knowledge is not only cultural heritage but might be highly valuable for many purposes, for instance, to secure the sustainability of gardening or to conserve endangered elements of agrobiodiversity in homegardens (Niñez 1987; Chambers, Pacey, and Thrupp 1989; Fujisaka and Wollenberg 1991; Vogl-Lukasser and Vogl 2002). Our arguments for more research on homegardens are also based on our experience; these are wonderful sites for field research, and it is inspiring to interview people who are eager to share their passion for working in homegardens. Finally, we recognize that documenting homegardens may be of potential interest to researchers from other disciplines—for example, studying alpine ecology, household economics, social networks, the spread of market economies, the effects of regional development policies on local communities, and even knowledge and its cultural transmission (see Martin 1995; Cotton 1996).

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To enhance ethnobotanical research on homegardens and to encourage a discussion of scientific methodology, we present here the tools and methods we have used to collect data while studying homegardens of Ch'ol and Tzeltal migrants of Lowland Chiapas in Mexico (Vogl 1998; Vogl, Vogl-Lukasser, and Caballero 2002) and of Eastern Tyrolean farmers in Austria (Vogl-Lukasser and Vogl 2002; Vogl-Lukasser, Vogl, and Bolhar-Nordenkamp 2002; Vogl and Vogl-Lukasser 2004), and in Kalimantan, Indonesia (Puri 1997, 2001; Sheil et al. 2002).

We start by defining a homegarden and its gardener. Then we present some of the research questions and hypotheses on gardening that we use in our work. We discuss how we sample homegardens, how we initiate conversation with gardeners, and what equipment we take with us. We set out which kind of questionnaires and questions we use and how we manage our data. The methodological protocol is a synthesis of methods we have developed and those used by other scientists around the world. The methodology is not yet fully developed, as it is still in process and under discussion. We want to make the process public and encourage discussion on ethnobotanical homegarden methodology. Data analysis for ethnobotanical studies in homegardens will follow in another publication.

DELIMITING THE STUDY AREA: WHAT IS A HOMEGARDEN?

The location relative to a home, tenure, and purposes of gardens vary in different parts of the world, but some types of gardens are easily recognizable across different cultures.

In the scientific literature on ethnobotanical research into homegardens, the gardens studied are also known as house gardens, household gardens, or kitchen gardens. Their defining criterion is that they are adjacent to the house where their gardener(s) live. These can be urban homegardens (private garden adjacent to a house in a town or city) or rural homegardens (garden adjacent to a house in a rural area [solar in Chiapas, Spanish; *Gartl* or *Gorte* in Eastern Tyrol, German; *kebun rumah* in Kalimantan, Indonesian]).

Homegardens can be distinguished from other types of gardens, such as an urban garden (a garden plot at significant distance from a house in a city—for example, urban allotments in the United Kingdom and *Schrebergarten* in Austria), a rural garden (a garden a significant distance from a house in an area surrounded by other types of cultivated lands (for example, *Kobisgorte* in Eastern Tyrol, Germany; *kebun ladang* in Kalimantan, Indonesia), and

other types of gardens, such as parks, botanical gardens, and community gardens.

In homegardens studied by ethnobotanists, the gardeners usually grow fruit, vegetables, herbs, and ornamental plants, primarily for subsistence and for their own enjoyment. But the uses of homegardens vary—some are used for the commercial production of vegetables, while others have only lawn and ornamental species.

Before undertaking a project on gardens, one has to know which kinds of garden exist in the study area. In many cases, one will find gardens of several types. The choice of which types to investigate depends on the researchers' personal interests, available funds, time, research questions, and hypotheses—for example, whether we need a homogeneous sample (e.g., for the study of the cultural domain of gardening among a specific group of people) or a sample with maximum variation (e.g., a comparative study of different types of homegardens).

In our past research, we used an etic classification of the types of gardens present based on categories such as those listed above, and we decided which gardens should or should not be studied. In Kalimantan, for example, gardens both near the house and at distant rice swiddens were examined as part of an ethnobiological survey of the Bulungan area. Among the Maya in Chiapas, we only examined plots surrounding the homes. In Eastern Tyrol, gardens adjacent to residences were studied, but homegardens of the non-farming rural population were excluded. In a current project in Lower Austria, we limit the sample further by eliminating homegardens with only ornamental plants, lawns, and exotic coniferous shrubs.

An ethnoecological approach to the study of garden classification would involve preliminary work to elicit and corroborate local categories of ecological representation. These might include a generic category of “garden” and several specific subcategories (e.g., “coffee garden,” “field garden,” “home garden,” “cocoa garden”; Meilleur 1986; Puri 1997, 2001). Once these have been mapped and several examples of each type surveyed, then we can decide which classes to study. Using local classification systems for cultivated areas can make it difficult to make cross-cultural comparisons because different criteria (such as function or geographic location) may underlie contrasted categories. However, local categories may ultimately prove more meaningful in explaining any variation in floristic diversity and gardening practices.

The need to clarify what is and what is not included in a sample applies also to the study of gardeners. In the Chiapas projects, each homegarden was tended by several gardeners, all being members of the family and each performing different gardening tasks. There, we could not refer simply to gar-

deners but had to make explicit which gardener we were talking about—wife, husband, or female or male children. All people assuming any responsibility and working in the homegarden should be considered as potential gardeners. In the Tyrolean project, we learned that homegardens are the responsibility of female farmers only. Therefore, in Tyrol, the gardener and the main respondent is the female farmer.

RESEARCH QUESTIONS AND HYPOTHESES

We are not discussing general issues of how to develop new research questions and hypotheses here. Many authors have already written about this, and their publications should be consulted before undertaking an ethnobotanical study on homegardens (Caballero 1992; Miles and Huberman 1994; Martin 1995; Alexiades and Sheldon 1996; Cotton 1996; Bernard 2002). However, we do present some examples of contemporary questions (Q) and hypotheses (H) that are basic to documenting homegardens as well as a few innovative ones that address current theoretical interests in ethnobotany and environmental anthropology, in general.

- Q:* Do attributes of the homegarden, gardener, and/or study area affect the floristic diversity of homegardens?
- H:* The further away a homegarden is from a retail outlet for produce (e.g., shop, market), the higher the diversity of species that the family needs for subsistence.
- Q:* Are “old,” nonhybrid varieties still grown in homegardens?
- H:* If older members of the family with “old-fashioned tastes” still live at the farm, then older, nonhybrid varieties of cultivated species will be found in homegardens.
- Q:* Who are the primary sources for information on gardening techniques?
- H:* Knowledge of gardening is primarily influenced by a gardener’s peer group, where they are or feel like a member, rather than their neighbors.
- Q:* Why do people have homegardens?
- H:* Poorer gardeners supplement their diet with homegarden produce; richer people use homegardens for pleasure and ornamental uses.
- Q:* Does the presence of certain plant species or varieties serve symbolic, metaphysical, or ritual purposes?
- H:* Colorful ornamental plants are more likely to have emotional significance for their owners than less colorful plants.
- Q:* Does gardening contribute to communication in the community or to separation?
- H:* Homegardens of wealthier farmers are more likely to serve as status locations for social functions.
- Q:* How and why does the floristic diversity of homegardens change over time?

H: Where women engage in wage labor and spend less time at home, floristic diversity decreases and low-maintenance species predominate.

Q: Do inhabitants of urban centers recognize the existence and contribution of farmers' homegardens? What do they think about the purpose of homegardens? How does this correlate with the information provided by the owners of these homegardens?

H: Urban dwellers relying on supermarkets for food are more likely to be ignorant of homegardens and to hold negative stereotypes of farmers than those who shop at farmers' markets or health food stores.

SAMPLING HOMEGARDENS AND GARDENERS

Sampling depends on research questions and the circumstances of the research project—for instance, whether this is to be a cross-sectional (quantitative survey of as many homegardens as possible at one point in time) or a longitudinal study (study of processes and dynamism in a few locations for a longer period of time). These obviously require different sampling strategies. For our predominantly cross-sectional projects, we use a four-step approach.

1. Whenever possible, we prefer to use random sampling, for purposes of more rigorous statistical analysis and to allow the generalization of conclusions about larger populations. In a small village of indigenous farmers, as in the Chiapas and Kalimantan research, in which we could easily count and mark the units (homegardens), or in the case of Tyrol, where we have access to a complete list of all farmers in the study area, random sampling is relatively easy.
2. We use the randomly selected gardeners to find other informants in a manner similar to what Bernard (2002) calls snowball sampling. We also consider including people and homegardens encountered by chance in the course of a study.
3. We include an explicit historical perspective in our studies; therefore, we search for the eldest persons in the study area who might know something about the history of gardening, and we use the data for qualitative descriptive analysis.
4. Finally, we also contact all persons who have important functions related to gardening in the study area, such as members of gardening associations, extension agents, or owners of nurseries. Even if they are not included in the above samples, they often provide valuable information about gardens, gardening practices, and socioeconomic conditions in the study area.

For studies using a diachronic approach, we suggest limiting the sample size but repeating the studies every few years, especially during years of

unusual climatic variability or economic crisis, to study gardeners' responses to stressful situations.

EQUIPMENT

The equipment for fieldwork in homegardens differs little from that used in ethnobotanical studies in general (Martin 1995; Alexiades and Sheldon 1996; Cotton 1996). Here are a few recommendations for using equipment in the European contexts in which we now work. The student of homegardens must be prepared to work at a moment's notice. Gardens and gardeners are everywhere. There is nothing more disappointing than being at a dinner party made solely from garden produce without a camera or the means to record a discussion with the host about their garden. So, we keep our car packed with equipment and are ready for any opportunity to collect data.

We carry the following items with us at all times during our field research.

- our research diary;
- audio recording set with sufficient tapes and batteries, all having been tested;
- picture-recording equipment (one camera for slides and another for digital shots; camera for video sequences) with sufficient film and batteries; Polarizing, UV, and color filters, light meters, external flash; black marker pen, 15-cm scale, and a miniature whiteboard to indicate date, location, and name of plant in the image itself. We develop film regularly so that we can detect any camera malfunction at an early stage;
- plant press with all the required materials (such as labels, pencils, newspaper, cardboard, ventilators, dryers, etc.), including scissors, a trowel, and plant clippers to harvest the plant (see also Martin 1995; Alexiades and Sheldon 1996; Cotton 1996);
- data sheets and field book; pencil is still the writing implement of choice (we do not assume that all permanent pens are rainproof); Rite-in-the-Rain notebooks are a safe choice;
- list of names and contact details (address, telephone number) of all our respondents in the study area;
- a large plastic sheet, tarpaulin, or poncho to cover ourselves and all our equipment in case of unexpected rain, especially if gardens are in remote areas accessible only by foot or bicycle and where it is impossible to seek shelter in a car or house;
- relevant field guides and reference books for on-the-spot identification of unknown plant species;
- copies of letters of introduction (in plastic covers) that explain our aims and methods, with details of our identity and institutional background, including a

telephone number where we can be reached if someone has questions or wishes to discuss the project;

- a map of the study area, preferably topographic and high resolution; a remotely sensed image or aerial photographs of the whole study area;
- a telephone book to contact people recommended to us as potential respondents or experts on particular subjects;
- empty plastic and paper bags of many shapes and all sizes, wire twists, duct tape or other means to seal bags and boxes, and a permanent pen to store and label seeds and other artifacts; and
- water, snacks, insect repellent, suntan lotion, and a hat. We are not currently working in the tropics, but even in Lower Austria, a hot summer day and mosquitoes can make field research in gardens torturous if we are not properly dressed and equipped.

FIELDWORK IN HOMEGARDENS

We use a multidisciplinary approach, which combines botanical inventories; collection of plant specimens; structured, semistructured, and informal interviews; and classic anthropological participant observation. Informal data collection techniques provide a means for both getting to know informants and generating important insights that can be compared with results from our structured techniques.

Since gardening is often learned by doing, participant observation is one of the best ways to study the transmission of knowledge, especially nonverbal knowledge and skills associated with managing the soils and plants of a garden. While quantitative data on the abundance and distribution of garden plants are critical for comparative purposes, the use of free listing and other techniques from cultural domain analysis allow for quantitative analysis of typically qualitative data. For instance, we can search for variation in the importance of plants among informants through the use of free listing and cultural consensus analysis (Weller and Romney 1988; Ryan, Nolan, and Yoder 2000; Bernard 2002). We find that studying homegardens presents an excellent opportunity to use and experiment with these informal and formal techniques to collect both qualitative and quantitative data on current theoretical issues in ethnobotany and environmental anthropology. These might include the origins and maintenance of agrobiodiversity, the nature of ethnobotanical knowledge and its transmission, the effects of development and economic change on farming practices as well as the issues mentioned in the research questions listed above.

Identifying and Contacting Gardeners

In most cases, our visits to homegardens in Austria were arranged on the telephone. Gardeners were informed of the purpose of the study, and we asked permission to visit their house and homegarden. In several cases in Austria, as well as in Chiapas and Kalimantan, telephone contact was not possible, so gardeners were contacted, informed, and asked at the farm gate.

On the telephone, some gardeners demurred, claiming their homegarden was not interesting and tried to avoid being interviewed by us. This may be because of shyness or modest reserve; certainly, there are gardeners like this in every country in which we work. In Austria, to have a proper and beautiful homegarden is a kind of cultural necessity, but many informants feel their homegardens are not quite up to standard at the moment. These reluctant informants might just be afraid that the interviewer would see a pest, a disease, or a weed.

We tried to overcome these hesitant reactions by explicitly mentioning that we are interested in the homegarden as it is, without any interest in looking for the best or the most beautiful. Where appropriate, we explained that the gardener had been mentioned to us by a well-known person or a relative as knowing something interesting and that we would therefore like to meet them. After this, gaining permission and initiating conversation were usually not problems.

For those planning research on weeds, pests, or diseases in homegardens, we recommend surprising gardeners with an initial visit, otherwise most gardeners will weed and clean up the homegarden before you visit. When this is not possible, a pleading explanation that weeds and infested plants should be left until after your visit is necessary.

First Contact

In our experience, once we have introduced ourselves, gardeners in Chiapas, Kalimantan, and Austria are usually willing to talk about their gardens. However, we have found that gender and work schedules are factors that can influence the availability of farmers for interviews. Since gardeners in Eastern Tyrol and Lower Austria are primarily women, access was established more easily because female ethnobotanists conducted all the fieldwork. In Chiapas and Kalimantan, where both men and women work in homegardens, a male fieldworker needs to establish good relations with the males of a household before they can approach a women gardener for an

interview. Even then, a fieldworker must be careful to interview women only when men are nearby.

Gardeners occasionally refuse access to their homegardens or an interview for reasons such as high workload or other appointments. So, in Austria, we avoid visiting or trying to schedule appointments for busy times of the day (milking times, lunchtime, and after 8:30 p.m.) and of the farming year (harvest season). Postponing visits to later dates is thus not uncommon and should be expected. On the other hand, busy times in the agricultural cycle provide excellent opportunities for participant observation of farming practices, and there are few better ways to win friends than by offering to help out with the work. Clearly, different sorts of ethnobotanical knowledge and, if one is lucky, processes of knowledge transmission can be studied during these visits.

There are different ways to initiate conversation with gardeners. In general, we start with a detailed explanation of who we are and what we want and ask for permission to carry out our work. In our experience, our introduction often leads directly to an informal monologue in which the gardener expresses his or her particular and usually preferred gardening topic for that particular location and circumstance. That is, this initial discourse or “script” is specific to time and place and usually occurs without any prompting or questioning, other than our mentioning gardens or gardening. For instance, a gardener may expound on her favorite plant if she is initially contacted in her garden, while in her kitchen, the same informant might discuss processing, storing, and cooking homegarden produce. Each gardener has her or his favorite topics, and despite having the same interviewer, these are likely to be repeated during later encounters. Usually, at some point during this initial monologue, the gardener will apologize for the incomplete state of the garden and wish you could come at a time when it was finished. Thus, we found that no icebreaker or opening question was needed to initiate an interview with a gardener, but what we were told in an opening speech varied depending on where we made the initial contact. Clearly, more research is needed to understand the variation of these speech events and their underlying causes, but we recommend that careful attention be paid to these initial encounters.

Schedule of Field Activities

Our usual schedule for field research in homegardens in Austria requires four visits—one in each season, as described below. In Chiapas and Kalimantan, we usually visit a garden in both the dry and wet seasons. The purpose of so many visits is to monitor plant diversity over the course of a year and to spread the time required for interviewing over several visits. Vis-

its take place in the homegardens and in the homes of the gardeners. In Austria, our first visit may begin immediately after our first meeting with the gardener, but we usually make an appointment to return for the first survey. Proper preparation of the methods to be used during research is an obvious requirement. In our experience, it is equally important that the researcher is knowledgeable about the local flora, including crops and the most important varieties. This makes for quicker identification of plants in the gardens and greater understanding of information provided by gardeners.

1. Spring visit to the homegarden (may follow first contact with gardener):
 - informal first contact (described above);
 - structured interview (free list): free-listing preferences (e.g., most preferred species and reasons for growing them, most preferred products, etc.);
 - structured interview (data form): species list and ethnobotany; information about plants, plant management, and use;
 - inventory I (data form): taxonomic identification and abundance of plant species.
2. Summer visit to the homegarden:
 - inventory II (data form): check on the currently growing species and tasks, as in the first visit, for as yet unrecorded species;
 - structured interview (data form): unresolved questions from the first visit;
 - structured interview (data form): sociodemographic data on the gardener;
 - structured interview (data form): information on homegarden management.
3. Autumn visit to the homegarden:
 - inventory III (data form): check on the currently growing species and tasks, as in the first visit, for as yet unrecorded species;
 - structured interview (data form): unresolved questions from the second visit;
 - semistructured interview: history of the garden.
4. Winter visit to the homes of the gardeners:
 - informal interview of topics introduced by the gardener and the researcher.

All visits should be complemented by participant or nonparticipant observation of gardening tasks, such as soil preparation, seed or seedling selection, planting, weeding, watering, harvesting, and so forth. During these periods, one can check the accuracy of statements made during interviews and possibly learn a great deal more that might have been forgotten at the time of the interviews or that only reveals itself in the context of working in a homegarden. Of particular interest here are the skills and tacit knowledge enacted during these management tasks. If you are lucky, you may be able to observe the application of a farmer's expertise during unexpected events or accidental encounters with pests, weeds, or strange soil conditions. Farmers

can be expected to give a running commentary on what they are doing, often revealing motivations behind their choices of what to plant or uproot and when and where to do it.

Free-Listing Preferences

We used the informal situation in the entry phase of the conversation in the lower Austria study to ask for their three favorite plants in the home-garden. In the future, we will expand our data collection in this informal situation by the use of free lists on several domains (e.g., food plants, soils, pests, homegarden tasks) that will help characterize variation in gardening knowledge and practices among farmers. For these tasks, we follow closely the procedures outlined in the literature on cultural domain analysis (Weller and Romney 1988; Ryan, Nolan, and Yoder 2000; Bernard 2002).

Structured Interview on Garden Species and Ethnobotany

During these interviews, we walk with the gardeners through their homegardens. We point to every plant species and ask them the same set of pretested questions with a combination of precoded check-the-box questions, fill-in-the-blank questions, and open-ended questions (Martin 1995; Alexiades and Sheldon 1996). The type of question depends on the topic to be asked and on our knowledge of possible answers in the queried domains. As a result, we have a data sheet for every plant species in every homegarden.

The name(s) of the observed species are recorded as given by the gardener. This might be a name in local dialect or language, but it could be a name from a book or a commercial seed package. Regardless of the source of the name, we record it exactly as stated by the gardener. Our main concern is to get the specific gardener's name(s) for each species, which is critical for reducing the risk of misinterpreting our informant's statements. Voucher specimens or pictures are additional tools to prompt recall of particular species. When the respondent gives no name for a particular plant, we leave the space for the vernacular name blank, although it is tempting to add what we already know to be the common name. Nevertheless, in all cases, the scientific name for the species has to be ascertained at that moment to ensure that we can find the same species again if necessary.

Information on the use, propagation, and management of each plant species is entered into a data form with predetermined answers to every question. However, every question allows the insertion of answers that have not been preformulated. Several questions allow open-ended answers to be inserted into boxes or written on the back of the data sheet. In cases where the back of the data sheet is used, this must be clearly indicated on the front to

avoid having this information overlooked and lost. The proper use of the data sheet requires piloting and training so that interviewers learn to fill out the sheet efficiently and to ask questions in the structure and intonation of a normal conversation.

As an example, in our Eastern Tyrol study we were interested in the source of plants, seedlings, and seeds that are grown or propagated in homegardens. In a few exploratory informal interviews, we learned that plants in homegardens may be acquired (a) from previous owners of the homegarden, (b) by barter, (c) as gifts from neighbors or friends, (d) by collection and gathering from the wild, or (e) from various kinds of retailers. We used these categories as precoded answers and allowed the answer *other* (f) with an explanation. The same was done for possible uses, frequency of uses, management techniques in the homegarden, and so forth. Possible additional answers in the category *other* were then coded after all interviews were finished. Questions concerning processing, recipes, and specific uses in local customs did not allow for precoding. Answers were coded after all interviews were completed, except for some responses that were simply compiled and analyzed qualitatively.

Through the above-mentioned procedures, most plant species growing in the homegarden can be recorded and their initial descriptions taken during the first visit; for a garden with thirty species, we calculate about one-and-a-half to two hours of interview and survey time. For the first visit, we limit the interview to two hours to avoid overburdening the gardener. With additional visits and questions about the other species managed during the rest of the year, it is possible to achieve an almost complete inventory for every homegarden. However, this kind of intense survey method is not always possible. If there are only time and funds for one visit, then the fact that not all species could be recorded must be mentioned explicitly in the description of the methods used.

After this interview, our informants usually have to get back to work, so we ask if we may continue on our own to complete an inventory of the plant species and to collect voucher specimens. No informant has yet refused such permission, in part probably because we assure him or her that we will never take specimens from species with low abundance or a lone individual without prior consent.

Inventory: Abundance of Plant Species

If the permission to do further research is given, we continue to record the abundance of all plant species and to collect voucher specimens. Since this requires some time, we are generally happy if we can work without the pres-

ence of the gardener; on the other hand, if the gardener has time, he or she is invited to continue with an informal unstructured interview during these tasks. The presence of the gardener allows one to get a faster answer on whether voucher specimens can or cannot be taken from uncommon species.

Data on abundance are necessary to calculate diversity indices and yields (Begossi 1996), but counting plants in homegardens is a challenging task. Some species may be cultivated in dense patches or beds, such as grasses and some vegetables, making accurate counts of individuals very difficult. In these cases, sample plots need to be measured to establish equivalencies between units of area and numbers of individuals. For species growing in rows, like carrots, we measure the length of the row and count the individuals per defined length (e.g., individuals per 50 cm) to estimate the number of individuals in the row(s). For evenly dispersed and abundant species, we measure the number of individuals in a certain area (e.g., individuals per 0.25 m²). In some cases, what looks like an individual plant may, in fact, be a densely sown bunch of individuals; in others, what seems like several individuals may, in fact, be only one.

Areas already measured are marked to avoid recounting. For the task of measuring abundance, we rely on a calculator and tape measure, but we might also use colored stakes to mark off surveyed areas, rope with marks at every 10 cm for measuring odd-shaped areas, and a camera to document those areas where we are unsure of our findings.

To record the number of all individual plants (abundance), we use the same pretested data sheet as described above and insert the quantitative data. Counting individuals adds to the total amount of time spent in a homegarden and therefore significantly reduces the number of homegardens that can be studied in a given period of time. In spite of the effort required, we believe that this task is essential for a comparative study of the dynamics, economics, and diversity of homegardens.

Voucher Specimens

Plant voucher specimens, preferably from fertile individuals (i.e., those bearing fruits or flowers) are to be taken for all taxa and varieties found in the homegardens of the study area. As with all ethnobotanical studies, the aim is to provide evidence for the identification of all scientific varieties and species and their correspondence with local nomenclature. Collection numbers of voucher specimens should be cited as references for local names of species/varieties discussed or reported in publications. We make preliminary identifications of specimens in the field, often with the help of field guides and pre-

viously collected and identified specimens, and then take a set of vouchers to the national herbarium where we are working and send a set of vouchers to an internationally known herbarium (e.g., the Royal Botanic Gardens at Kew or the National Herbarium of the Netherlands in Leiden). We recommend establishing contacts at these institutions before you send them specimens.

To have voucher specimens from all species/varieties is a large and often unachievable task, especially for uncommon varieties and species. There are many species of which only one individual is found in a homegarden. Removal of this individual for a voucher specimen could lead to the disappearance of the variety/species in the homegarden and/or the region. In such cases, we take several photographs of the individual and check the botanical identification in the field very carefully. We recommend including an explanation of why these species have no corresponding reference material in any published inventory of these plants.

Voucher specimens are collected according to standard practice (Martin 1995; Alexiades and Sheldon 1996; Cotton 1996), including roots, flowers, and fruits where possible. In a homegarden with a hundred species on a hot summer day, with a curious gardener looking over our shoulders, making a full collection is almost impossible. Therefore, we collect up to three samples of every new variety and species encountered, so the number of vouchers collected is high at the beginning of the study but eventually tapers off (as predicted by a typical species-area curve). By the end, we were only looking for those species where vouchers were still missing. Diligent and accurate bookkeeping is essential when collecting.

This procedure can lead to mistakes—for instance, assuming we already have a voucher for an individual that turns out to be a rare variety or a similar species. Identifying plants from immature or sterile individuals increases this likelihood. Assuming a uniform correspondence between local vernacular and scientific nomenclature can also lead to the same mistake if we only record the local names of plants and do not carefully examine the individuals being discussed. In these cases, we force ourselves to go back to all the places where this species was previously found to be sure of its proper identification. To reduce the need, expertise in the flora of the area and systematics of cultivated plants, along with intensive sampling for vouchers at the beginning of the research.

Often voucher specimens cannot be processed in the homegardens. In these cases, we label all cuttings with a unique identification number and store them in large plastic bags to keep them fresh. We do not recommend collecting specimens from more than one homegarden in a day at the beginning of the fieldwork. It is better to prepare one set at a time and avoid the

problems associated with trying to prepare and dry too many specimens at once. We process our voucher specimens after every homegarden visit.

Mapping the Homegardens

We map the homegardens for some research questions (e.g., studies of the zonation of homegardens). Recently, excellent guidelines for mapping have been published that can also be used for ethnobotanical studies on homegardens, so we are not describing those procedures here (Kuznar and Werner 2001; Werner and Kuznar 2001).

Structured Interviews on the Gardener and Homegarden Management

In another visit, we ask the gardener about the attributes of the homegarden (age, changes in size, layout, etc.), the gardeners themselves (typical socioeconomic attributes, but also education about gardening, etc.), and the farm (farm size, crops grown, etc.). The data are recorded on pre-tested, precoded data sheets (“homegarden,” “respondent,” “farm,” as described below). These questions usually lead to the topic of the management of the homegarden (i.e., when are which practices employed and in what way? When, how, and at what frequency do gardeners irrigate? How do they harvest?).

These are questions of behavior to which we believe answers are straightforward and correct because the questions address typical daily activities that require the active attention and awareness of the gardener. Other questions address irregular or rare activities, which might be guided by customs or subconscious routine. We address all of these issues with carefully prepared questions, but we are very conscious of the limits of the interview process and the responses it generates. Therefore, we compare the responses with the results of participant and nonparticipant observation. However, we believe that this is still not enough. Research on the behavior of gardeners in certain highly interesting tasks (e.g., selection criteria for varieties grown, irrigation, relation of preferences to the management of homegardens) requires an explicit behavioral approach and cannot be achieved as a kind of add-on to the methodology presented here. This is a task yet to be tackled by our research team.

History

In our research, we include a diachronic perspective to understand the dynamics of gardening over time. The Tyrol study revealed highly diverse

homegardens (Vogl-Lukasser and Vogl 2002). However, oral histories of gardening in the area, collected from senior informants after the primary research tasks, suggest that highly diverse homegardens are a very recent development. We collected data on the past with semistructured interviews of the gardeners, especially with the area's eldest gardeners, many of whom had retired from gardening. In future projects, we will include archival research to better document the local history of gardening.

Maintaining a Nonjudgmental Attitude

All gardeners were very interested in the results obtained from visits to their neighbors and other homegardens. As a rule, we refrain from making comparative or value statements about a homegarden (e.g., "wonderful," "well kept," "not attended at all," "badly managed"). Instead, we offer descriptive statements, such as "She grows tomatoes and different herbs." We want to avoid fostering the perception that our survey is a competition for the better, the best, or the most beautiful homegarden. We also do not pass on specific technical information received by informants. Instead, we encourage farmers to contact each other directly—for instance, if they want to exchange seeds or plants. If this is not possible for some reason, we make arrangements to seek permission to pass on technical knowledge to others.

These rules (not to judge other homegardens and to keep technically sophisticated knowledge undisclosed) were followed and respected by our informants because we were quite open in discussing other types of information that they requested.

MANAGING OUR DATA

All of our data are stored in a Microsoft-Access database¹ that we developed for this purpose. For those readers unfamiliar with this program, the database consists of different tables for the different categories of information collected during the study, which are linked hierarchically because they share several of the same fields or categories. Access allows you to create input forms that are exactly like the data collection sheets and questionnaires used in the field; and then it stores the entered data in these separate but linked tables. Access then allows you to manipulate the data by creating new tables that combine fields from the original data tables, such as a species list for each garden or even for the village. Our current database consists of the following tables:

- Village: table to insert all descriptive attributes of the community/village and where gardeners have been interviewed;
- Farm: table to insert all descriptive attributes of the farm and where gardeners have been interviewed;
- Homegarden: table to insert all attributes of the homegardens (e.g., size, fence type, slope, distance to nearest shop), its management (e.g., fertilization, irrigation), and its history (e.g., changes in size, purpose, species composition);
- Gardener: table to insert the attributes of the gardeners (e.g., gender, age, profession, higher education; reasons for gardening);
- Ethnobotany: table to insert knowledge recorded from gardeners on each plant species (e.g., local name, use, propagation methods); and
- Botany: table to insert information on each plant species and its attributes from literature (e.g., scientific name, life form, if annual, biannual, or perennial).

Fields of the tables are linked, so that data are inserted just once, which is faster and reduces the chances of error. For example, scientific names of plants are inserted only once in the respective field of the botany table. The list of plant names is carefully checked there. As data for the use of a specific plant are entered in the ethnobotany table, the field of the scientific name has to be filled in only with the first letters of the name and then the correct name is chosen from a menu drawn from the botany table. While this method of storing data may seem complicated at first, we find it to be extremely versatile for generating input and output forms and analyses and for saving time and reducing errors in entering the data.

CONCLUSIONS

In this article, we have described a selection of tools and methods for the multidisciplinary study of homegardens from both a botanical and an anthropological perspective. In particular, we recognize that homegardens are a nexus where biological and cultural diversity are inextricably linked (Posey 1999; Prain, Fujisaka, and Warren 1999; Warren, Slikkerveer, and Brokensha 1999; Maffi 2001) and are thus valuable sites for the conservation of agrobiodiversity (Hammer 1998) and related knowledge. Investigating evolutionary processes and the correlation of various domains of diversity in homegardens requires the broad-based approach of an ethnobotanist and a set of methodological techniques designed to illuminate the interface between nature and culture.

We have emphasized here that studying homegardens presents an excellent opportunity to use and experiment with informal and formal techniques

to collect both qualitative and quantitative data. We would not have learned much of the history and cultural context of gardening in our study areas if we had not included semistructured, unstructured, and informal interviews as part of our methodology. They provide means of getting to know informants as well as generating important insights that can be compared with the results of our structured techniques. On the other hand, the use of free-listing and other techniques from cultural domain analysis allows for quantitative analysis of typically qualitative data. There are many more tools and methods available for studying homegardens, such as participatory mapping, seasonal calendars, transect walks, and focus group interviews, which we will experiment with in future projects in both Austria and the United Kingdom. We hope the issues raised in this article will encourage further studies on homegardens and serve as starting points for discussions of methods used to examine them.

NOTE

1. Available online at http://www.boku.ac.at/oekoland/MitarbeiterInnen/Vogl/Vogl_methods.htm

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