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Biology in Language Documentation

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The fields of ethnobiology and language documentation have much to offer each other, but for the moment, there are few signs of engagement between practitioners of the two disciplines. In this paper, I argue that projects that seek to document endangered languages can benefit by focusing on the semantic domain of traditional biological and ecological knowledge (TEK), and by engaging in collaborative projects with ethnobiologists. In doing so, researchers not only produce a rich corpus that is culturally relevant and valuable to the language community, but also record information about the natural world that may be of interest to researchers in other fields. The TEK encoded in a language is best and most easily observed in the specialized vocabulary that speakers may employ when talking about various natural phenomena. However, a community's knowledge of their biological environment extends far beyond the lexicon and into the domain of complex ecological relationships among different organisms. Using examples from my fieldwork in southern India, I argue that it is possible to capture such knowledge in a language documentation program. Other criteria for a good documentation, such as the inclusion of a wide range of speech genres, can also be met while eliciting TEK from language consultants.

1. INTRODUCTION. The ethnobiological knowledge or traditional ecological knowledge (TEK) of non-industrialized societies has, in recent decades, come to be viewed not only as an important part of the community's cultural heritage, but also as a vital resource for researchers involved in activities like conservation biology (e.g., Ramstad, et al. 2007; Ban, et al. 2009). As a result, many biologists are now calling for an active engagement with such communities, with a view to making them stakeholders in any conservation efforts. In many cases, such partnerships have led to real-world conservation outcomes that have benefited both the community and the natural environment (e.g., Klubnikin, et al. 2000; Becker & Ghimire 2003). There is also a growing awareness that the work of linguists and anthropologists only further strengthens this enterprise, as their culturally-sensitive "emic" perspectives perfectly complement the biologists' "etic" compendium of objective facts (Drew & Henne 2006:36). The work of language documentation is similar in many ways to that of conservation biology, in that both are contingent on a strong appreciation of diversity. While it is heartening that language documentation has developed into an independent field of research in recent years, this young discipline also has much to gain by engaging with other, complementary fields. Speakers of small, endangered languages, especially those situated far from urban centers, routinely engage with their natural environment, as they go about the mundane tasks of obtaining food, fuel, water, and building material. The languages of such communities come to encode much encyclopedic knowledge about biological and ecological entities and phenomena. This knowledge is as important as the knowledge of religious practices, local customs, and taboos in allowing a person to be a fully-functioning member of a community.

In the following sections, I argue that language documentation projects should capture as much of a community's ethnobiological knowledge as possible. I even suggest that it

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is possible for a documentation project to focus on the biological/ecological semantic domains, while still resulting in a rich record of the language. The examples I present in the paper have originated from my fieldwork with the Solega (Dravidian; "Sholaga" in *Ethnologue*) speakers of the Biligirirangaswamy Hills (or B.R. Hills) in the southern Indian state of Karnataka.[1] The Solega are a society in flux, their traditional hunter-gatherer lifestyle and forest understory-burning regimes having been curtailed by the Indian government in the 1970s. Many young Solega now exclusively speak Kannada, and are moving to nearby towns and cities to find jobs. The repercussions of these changes on TEK, and its transmission within the community, will become evident later in the paper. First, however, since the term *ethnobiology* is understood to mean different things by different researchers, I provide a brief, non-exhaustive survey of the types of investigations that can be carried out under its banner. The following will be useful to readers with a linguistic background who may be interested in incorporating ethnobiology into their research or documentation programs, but are uncertain of where to begin, or what it entails. Readers who are already familiar with various aspects of ethnobiological research may wish to start with section 4, which offers some suggestions on the types of linguistic data that can be collected while carrying out TEK-based language documentation.

2. DEFINING *ETHNOBIOLOGY*. *Ethnobiology* is practiced in many guises by researchers with diverse skill sets and academic persuasions, and so it is unsurprising that this term now encompasses studies that approach the investigation of TEK from a variety of angles. An obvious entry point into the biological domain in a given language is the naming and folk taxonomy (classification) of living organisms in that language. This facet of ethnobiological knowledge has generated much research interest in recent years, with considerable effort being expended on the question of whether there are universal patterns in folk classifications across the wold's languages. An influential publication in this respect was Brent Berlin's (1992) *Ethnobiological Classification*, a summary of more than two decades of research by Berlin and his colleagues on this topic (see also Berlin 1972, Berlin 1973, and Berlin, et al. 1973). This monograph presented evidence from unrelated languages to make a case for the existence of many linguistic universals in folk classification and nomenclature. Since then, there has been a flurry of reports from ethnobiologists scattered around the globe purporting to "confirm" the claims made in Berlin. Some researchers remain skeptical, however (the present author identifies with this group, but see also Dwyer 2005 and Baker 2007), and maintain that far more languages need to be investigated in detail in order to address the issue of universals.

A language community's knowledge of the natural world cannot be easily teased apart from what might be loosely termed "cultural" knowledge; the latter, in turn, often runs seamlessly into the domain of religious belief. The interaction between the seemingly objective knowledge of the natural world and a community's subjective cultural attitudes

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and belief systems can be an interesting field of study in itself. This is best exemplified by the writings of the English anthropologist Ralph Bulmer, who worked extensively with the Kalam people of Papua New Guinea in the 1960s and '70s. In his classic paper *Why is the cassowary not a bird?* (Bulmer 1967), he convincingly demonstrates that there are many reasons why Kalam speakers do not classify this large flightless bird as a *yakt* 'flying bird or bat'—these reasons go beyond mere objective "facts" such as physical appearance or lack of flight, and are instead firmly situated in the very special (kin) relations that cassowaries are meant to share with humans in Kalam mythology (Bulmer 1967). Incidentally, Bulmer (1974) himself suggested a typology of ethnobiologists, including investigators whose primary orientations were (i) lexicographic, with an emphasis on biological vocabulary; (ii) formal, in that they focused on taxonomic logic; (iii) social, Roy Ellen being prominent among these (see below); (iv) biological, i.e., professional biologists who develop an interest in traditional knowledge systems; and (v) natural-historical, of which category Bulmer claimed membership.

The management and use of a particular natural resource by a community has frequently been investigated by anthropologists and ethnobiologists. A good example in this respect is the study by Roy Ellen on the cultivation and harvest of sago palms for their edible starchy pith by the Nuaulu of eastern Indonesia. Ellen (2004) discusses how a variety of factors—ecological, genetic, and anthropogenic—have conspired to minimize the visible morphological variation in sago palms, and how this has resulted in a reduced number of varietal names for this species (in contrast to other heavily cultivated species like rice and bananas) in various languages in this part of the world.

Indigenous knowledge of local ecosystems, and the species contained therein, has great potential to inform scientists and conservationists of hitherto unknown aspects of ecology and behaviour. It has been noted that the "diachronic" knowledge base ("diachronic" in that the knowledge has been collated over innumerable generations) of traditional peoples perfectly complements the "synchronic" observations of western science (Gadgil, Berkes & Folke 1993). The past decade has seen a great deal of interest in such "applied" aspects of ethnobiology, as scientists come to realize that much can be learned from indigenous peoples about sustainability, natural resource management, or even basic biology (Ramstad, et al. 2007). Subsistence or artisanal fishermen, for instance, can be a valuable source of information about the breeding habits, diet, and migration patterns of commercially important fish (e.g., Silvano & Begossi 2005). The information gathered in such studies is often new to science, and may prove crucial to the management of rare or endangered species.

The types of studies described above have the potential to document information about the natural world that is valuable not only to the indigenous communities consulted in the studies, but also to academics in a range of fields. However, one major drawback of some ethnobiological studies is that the data are presented in the academic literature in a form that is, for all practical purposes, inaccessible to the community. Such studies not only inadvertently deny their consultants the ability to access their own traditional knowledge, but also implicitly value "content" over "form"—that is to say, the biological information—over the language that encodes that information. In recent years, however, there has been a significant emphasis in ethnobiological research on the return of TEK to local communities in a usable form. Notable examples include projects such as the People and Plants

initiative, jointly funded by the Royal Botanic Gardens in Kew, UNESCO, and WWF; the Terralingua project, which seeks to promote biocultural diversity; and also individual researchers who aim to produce multilingual resources such as the Tok Pisin and English *Reite Plants* handbook (Nombo & Leach 2010). Modern ethnobiological textbooks and field guides now regularly include a section on language—for instance, the useful introduction to basic linguistic concepts and methodologies in Gary Martin's *Ethnobotany* (Martin 1995). Similarly, a section in Fikret Berkes' *Sacred Ecology* draws the ethnobiologist's attention toward various linguistic issues that could confuse the task of data collection, and also warns against clinging to one's own personal linguistic prejudices while conducting fieldwork (Berkes 1999). More recent edited volumes, such as Maffi (2001b) and Anderson, et al. (2011) contain comprehensive listings of articles that describe current efforts across the globe to protect and foster both linguistic and biological diversity.

3. WHY DOCUMENT INDIGENOUS BIOLOGICAL KNOWLEDGE? Linguists can make a valuable contribution to the safeguarding of TEK by implementing language documentation projects that focus on biological knowledge as a core semantic domain. By doing so, researchers may easily and systematically document not only the form and sounds of an endangered language, but also a substantial portion of the meaningful content of that language. The advantages of choosing to document primarily ethnobiological knowledge are many:

3.1 RELEVANCE TO DAILY LIFE. Knowledge of the natural environment may be highly relevant to the members of language communities that are situated far from urban centers and still practice traditional methods of subsistence. For many such communities, possession of appropriate TEK is central to being a functional member of those communities—such knowledge is, after all, necessary for the identification of appropriate foods, for the avoidance of dangerous organisms, for the correct interpretation of seasonal cycles for agricultural or religious purposes, and so on. Important biological events may dominate people's conversations for weeks or months at a time: among the Solega, the annual migration of three honeybee species from the lowlands into the highland forests, as evidenced by the dozens of swarms passing overhead daily, is eagerly discussed by young and old alike. *Ba:ge maraka je:nu banda:de* 'the bees are nesting in the *ba:ge* tree,' a person will say to his friend, letting the latter know that the bees have once again taken up residence in the same nearby tree that they inhabit every single year. The special status of such trees in Solega culture is illustrated by the fact that many are given proper names known to all community members. "*Do:u ma:vu ba:ge*," then, is a particular *ba:ge* tree in the forest, named after the locality in which it is to be found. An invitation to go to *Do:u ma:vu ba:ge* could only mean one thing: a honey-collecting trip. Children will frequently report finding small hives to their older relatives, while older folk offer advice in the form of names of places where certain types of honeybees congregate. Honey harvesting goes on for about three months of the year, and during this time, a wealth of material on TEK of honeybees, as well as on cultural or utilitarian interactions between humans and this important social insect, can be documented.

3.2 EASE OF ELICITATION. It is for the reasons mentioned above that language-encoding aspects of TEK can be readily elicited from language consultants, as long as the right questions are asked. A question along the lines of "Tell me what you know about elephants" is likely to yield a patchy, superficial picture of a consultant's mastery of elephant lore; yet, this might be well suited to a pilot study or the start of a field season, when the researcher is still coming to terms with the organisms and natural phenomena that occur at a new field site. Such a "shotgun" approach is useful in informing the researcher about the breadth of a consultant's TEK (though at the cost of depth). At a later stage, a fieldworker might feel confident enough about his or her own understanding of the community's TEK to ask more probing, directed questions, such as, "What are the signs that indicate the presence of nearby elephants?" The researcher would probably then be rewarded with an outpouring of linguistically rich and biologically nuanced information, a narration that passes frequently and effortlessly from one branch of the speaker's mental associative network to another. This narration might well encompass aspects of elephant lore that the researcher had never thought to inquire about, including the lexical items used to classify elephants by age and appearance, details of elephant nutrition or habitat preferences, migration patterns and reproductive behavior, any "just-so" stories that purport to explain particular features of elephant behavior or anatomy, or simply stories about chance encounters with wild elephants. Approaching the topic of elephants as a natural entity that humans interact with therefore has the potential to yield a far more elaborate and culturally salient linguistic corpus than simply asking a consultant to "Tell me the story of how the elephant came into being."

3.3 RANGE OF SPEECH GENRES. A good language documentation project should seek to record as much as possible of the range of speech genres or registers that exist in the language. These speech genres are normally characterized by differences in thematic content, style (the selection of certain lexical, grammatical, and phraseological resources of the language), and compositional structure, and manifest themselves as relatively stable utterance types peculiar to each sphere of communication (Bakhtin 1986). More recently, and in the context of language documentation, Himmelmann (1998) has proposed the idea of "spontaneity" as a parameter for differentiating between types of communicative events. From the "unplanned" to the "planned" ends of the spontaneity spectrum, language documentation should then ideally contain specimens of exclamatives, directives, conversations, monologues, and ritual language. With this in mind, I suggest that by focusing on biological themes, language documenters can have easy access to the different speech genres that exist in a language. Asking a group of language consultants to identify a plant (either a specimen, or *in situ*) can often generate lengthy or even heated discussions, especially when the plant in question is rare or cryptic. Such an activity can facilitate the documentation of completely natural and unrehearsed conversation, with consultants perhaps contradicting each other's assertions, pointing out salient identifying features that the others may have missed, or defending their points of view through reasoned argumentation. In the following exchange, NJ and two other consultants (JV and JS) disagree about what the landscape term *na:ḍu ka:ḍu* really means:

NJ: *Na:ḍu ka:ḍu andare baidu, alli ondu mara giḍa ya:vadu iralla.*
'*Na:ḍu ka:ḍu* means it's open, there isn't a single tree or plant there.'

JV: *Adalla, adalla!*
'That's not it, that's not it!'
JS: *I: ka:ḍu no:ḍi, gavi bore kelagaḍe.*
'Look at this forest, below *gavi* bore [place name].'
JV: *Ã:, adu na:ḍu ka:ḍu.*
Yes, that's *na:ḍu ka:ḍu.*
NJ: *Kutare ga:ḍu adu! Jami:niga se:rtade, adu baidu ka:ḍu.*
'That's *kutare ga:ḍu*! The one that's adjacent to farmland, that's open forest.'

Similarly, it is a straightforward matter to elicit utterances in a narrative speech genre—a consultant might be asked to relate the story of someone getting attacked by an elephant:

Avana eḍti, solpa varsadallie adu. Ave:n ma:ḍtidda? Geṇasina guḷiya aggetidda, maṭṭa ka:ḍinalli…. A:ga oḷeka baggi etta:ku hi:ge, kai etti hi:ge. Aga baggadakka:ue me:le bandu a:ne! Noṭṭi me:le maḍagu uḍtu. Oḷekave. Ava alligave meṭṭu uṭṭattu.

His wife, she was very young. What did she do? She dug a hole while looking for yams, in the flatland forest…. You need to bend down and reach into the hole like this, you need to put your hand in like this. As she was bending down, an elephant showed up! It struck her on the back. She fell in. It trampled her right there.

Descriptive texts can be elicited by asking a consultant to describe a type of forest or landscape, or the behavior or biology of local animals:

Ra:ṇi noṇa andare, adu ondu ta:yi tara je:nugaḷige…adu jopa:na:gi no:ḍkoḷḷutte. Adu ashṭu huḷa iruttella, ashṭu huḷa adu biṭṭu koḍalla, ella huḷa ue no:ḍkoḷḷutte.

As for the queen bee, she's like a mother for all the bees…she looks after them carefully. However many bees there are, she never leaves them, she looks after all of them.[2]

In Solega, one can even gain access to the "highest" registers of the language while remaining firmly within the biological domain. Examples of this include the annual pleas to

[2] At first glance, this might seem to be a fairly unexciting and basic piece of biological information, one known to most western schoolchildren. However, despite over two millennia of beekeeping in Europe, the knowledge that the "leader" of the hive, i.e., the queen, is actually female, became known to western science only in the mid-seventeenth century. Aristotle, often called the "father of natural history," could not accept that the head of a beehive could be a female, in spite of having access to beekeepers (Aristotle 1953), and the misconception that only a "king" could lead an insect society was widespread in medieval and renaissance times (Woolfson 2009). This example demonstrates that even very familiar, seemingly commonplace (or even common-sense) aspects of traditional knowledge can still illustrate significant biological insights on the part of the holders of that knowledge. It would not be right to dismiss offhand any piece of information simply on the basis that it had long ago been discovered by western science.

the Solega's elephant god, *a:ne de:varu*, to protect one's family and crops from harm; the lengthy song cycles, *ha:ḍuke*, sung through the night at festivals, in which the animals of the forest are invoked one at a time, and their godlike status proclaimed; or the "honeybee" songs sung at honey harvesttimes:

Kembare bareyalli je:na:de *Ka:rana kareyo ka:raiyya*	There is honey at Kembare Bare, [Invocation of the God Ka:raiyya]
Kembare bare je:nu kenje:nu *Ka:rana kareyo ka:raiyya*	The bees at Kembare rock are red bees, [Invocation of the God Ka:raiyya]
Soppi nerake ka:ra:na	O Ka:ra:na who dwells in the shade of the leaves!

3.4 PLENTY OF MATERIAL. Biological themes are likely to be very heavily incorporated into the language of non-urban communities. The Solega lexicon alone probably contains roughly 400 plant names, 100 bird names, 40 mammal names, and a similar number of named invertebrates. Naturally, TEK extends far beyond the lexicon, and the information possessed by the average adult Solega language consultant on the ecological relationships, life-cycles, and distribution patterns of forest organisms rivals that of the professional naturalist. This point will be elaborated in later sections (see sections 4.2 and 4.3).

3.5 OFTEN-NEGLECTED PART OF LANGUAGE STUDY. With some notable exceptions, the bulk of ethnobiological research is today carried out by investigators with training in fields of natural science such as botany or epidemiology—this assertion can be confirmed by skimming the institutional affiliations of authors who publish in periodicals such as the *Journal of Ethnobiology* and the *Journal of Ethnobiology and Ethnomedicine*. While a significant number of the papers published in these journals are the result of collaborative work between a natural scientist and, say, an anthropologist, the primary goal of many such studies remains, as mentioned earlier, the documentation of traditional or indigenous *knowledge*, rather than the *language* in which the knowledge is encoded. This is a great pity, for such an approach not only renders the collected data largely unusable for the purposes of language maintenance or revival, but also completely misses any interesting linguistic features that might be unique to the biological domain, such as metaphorical usages (Krupa 1996). Nabhan (2000, 2001), for instance, provides evidence from two neighboring languages spoken in Arizona and Mexico that many plant and animal names encode information on ecological relationships between a species and another organism in its environment.

While many ethnobiologists have an interest in the language(s) of the communities they work with, and many linguists are keen on incorporating TEK into their research programs, it is unlikely that any single researcher would have all the skills and resources necessary to carry out a systematic, accurate documentation of both the language and the TEK of a community. An anthropologist or ethnobiologist with no formal training in linguistics or language documentation might produce a corpus of TEK that is erroneous (e.g., in terms of transcriptions of indigenous names, or of the semantic ranges of lexical items), while a linguist with little background in biology or ecology might struggle to ask relevant questions or completely miss important biological phenomena occurring in the field. An

ideal solution to this problem would be for linguists and ethnobiologists to forge collaborative alliances, through which the parallel aims of language and TEK documentation could be achieved. Language diversity often correlates well with biological diversity (Maffi 2001a), and it would not be unusual for researchers with interests in both subjects to work in the same field locations. Partnerships between practitioners of the two disciplines should result in research outcomes that are not only comprehensive and reliable from an academic point of view, but also immensely more valuable to communities whose language and traditional knowledge are simultaneously endangered.

4. WHAT NEEDS TO BE DOCUMENTED? In the event that collaboration between a linguist and an ethnobiologist cannot readily be arranged, it is still possible for language documentation carried out by a linguistically competent fieldworker to result in a rich corpus of TEK. The following provides some general guidelines for linguists who might be new to ethnobiology on the types of data that can be elicited in the biological domain.

4.1 LEXICON. Many ethnobiological studies focus solely on the lexicon of a target language community, as is the case when compiling a list of the medicinal plants used by the community, along with their methods of administration. This is a perfectly reasonable starting point in a language documentation project, as long as the data acknowledge the rightful place of each item collected as part of a complex web of ecological interactions with other named entities. This point will be further discussed below. The collection of lexical data is a task that is greatly appreciated by community members, as it readily demonstrates the richness of their language. According to Pawley (2009), the lexicographer's mandate typically covers specialized fields of knowledge as diverse as botany, ornithology, ichthyology, and other domains of natural history, anatomy and physiology, social anthropology, horticulture and aboriculture, carpentry, weaving, geology, soil science, meteorology, and so on.

The loss of such specialized lexical forms from contemporary speech (especially that of the younger generation) is often painfully obvious to older speakers. The parts of the lexicon dealing with TEK are arguably the most threatened aspect of many, if not most, endangered languages, and it is not uncommon to hear the complaint, "Our children don't even know the traditional names of the big trees/birds/sacred places anymore." For the Solega, this situation has come about in recent decades due to a variety of factors, including the lifestyle change brought about by the creation of a wildlife sanctuary on their lands in the early 1970s, leading to their confinement to permanent settlements, the banning of traditional burning practices by the local forest department, and the invasion of the woody weed *Lantana*, which has driven many understory plants to local extinction. Many plants, birds, and animals that were once part of the Solega's immediate environment and everyday life are now rare or altogether absent, and are therefore not talked about anymore. This has resulted in a severe disruption to the transmission of TEK to younger generations.

The Solega lexicon contains a very fine-grained categorization of salient natural phenomena; this often differs significantly from the categorization for equivalent concepts in the neighboring Kannada lexicon, despite the close, almost dialectal relationship between the grammars of the two languages. For instance, Solega speakers differentiate between a variety of forest types based on their locations, species composition, and a host of abiotic factors (Fig. 1). Most of these terms would be unfamiliar to Kannada speakers. Both Kan-

nada and Solega have a "rain calendar," wherein the rains (an average of two per month) that fall throughout the year are given names, much like the months in the Gregorian calendar. However, the Solega calendar has additional rains, two of which—namely *taragu* 'leaf litter' and *kariaḍaka* 'wet soot'[3] —indicate when the traditional leaf-litter fires are to be lit for clearing land. Another interesting example of lexical exuberance is the 20 or so terms for classifying elephants, based on appearance, age, group membership, and gender. At least 11 of these terms are descriptors based on tusk morphology alone (Fig. 2). Again, the vast majority of these terms do not exist in modern Kannada.

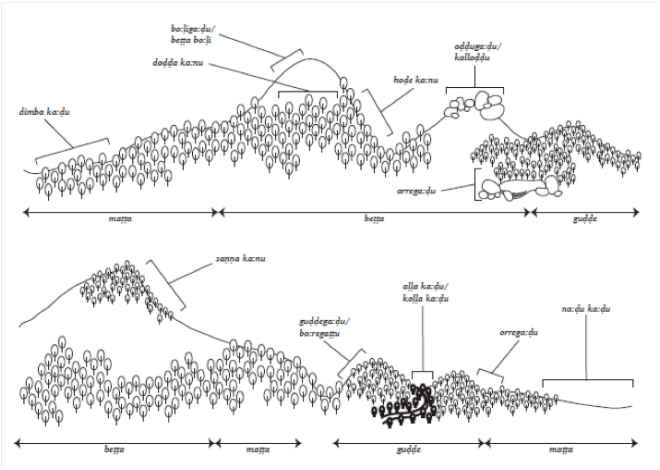

FIGURE 1a. Vegetation types in Solega

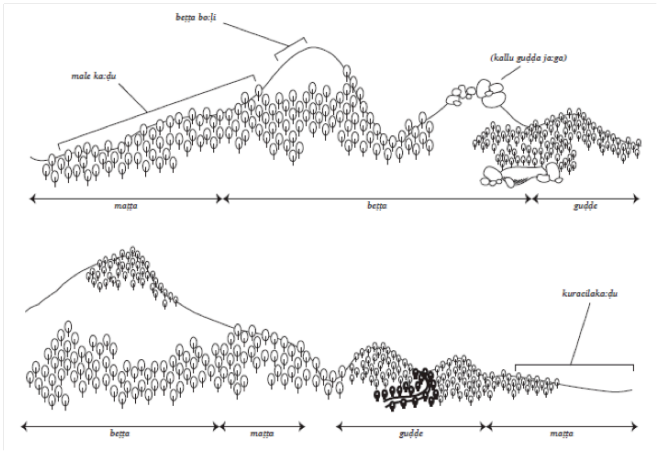

FIGURE 1b. Vegetation types in (urban) Kannada

[3] These are the two earliest named rains of the year, falling in February and March, respectively.

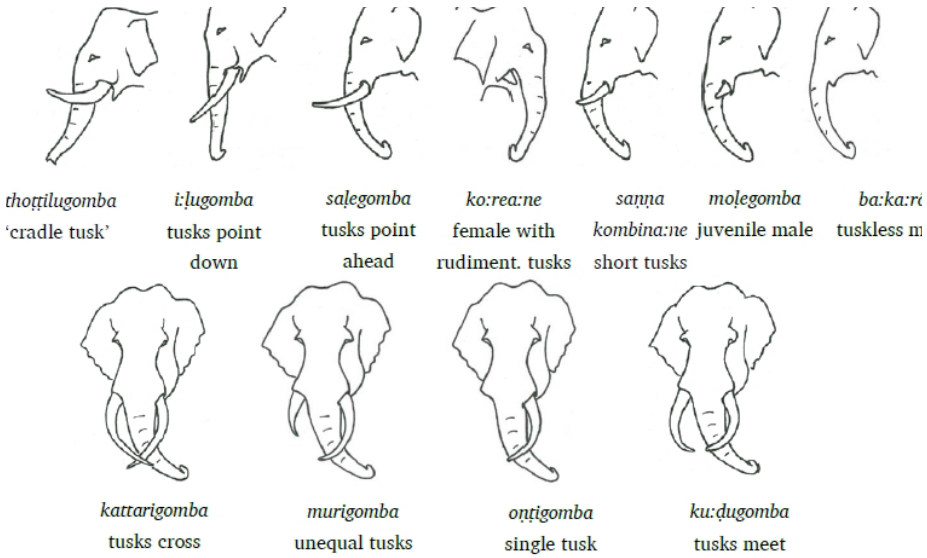

FIGURE 2. Some Solega elephant terms. The categories are based on tusk morphology.

4.2 LEXICON—MORE THAN JUST A WORD LIST. Words are without doubt the building blocks of a language, but a list of words with no indication of their real-world referents is of no value to either the speech community or other researchers. All too often, dictionaries contain entries like the one in figure 3a. This is sometimes unavoidable: a language consultant may point out a half-eaten lizard during a walk through a forest, and say, "We call that an X." Chances are, that type of lizard will never again be encountered by the language documenter, who would then have no choice but to state "X: a kind of lizard" in the forthcoming dictionary. However, as Evans & Sasse (2003) point out, a challenge that needs to be seriously addressed by linguists is capturing meaning in a stable form in a documentation project. They suggest that this can be achieved in two ways: first, the *web of use*—hearing, again and again, which signs work with other signs to form larger units, including patterns of paraphrase—and secondly, the *process of ostension*—of illustrating what some words mean by "pointing out" from the language itself to objects in our shared world. The first of these can be achieved through the addition of paralinguistic information, such as any uses of, for example, the named plant to be described, cultural/religious significance, and knowledge of known ecological links, all of which results in a far richer documentation. For the majority of biology-related lexical entries, there is no reason why a modern-day language documenter cannot at least make a visual record of the real-world referent of a word (Fig. 3b) by means of an easily-obtainable device, such as a small digital still camera—simple techniques such as this meet Evans & Sasse's second requirement. The addition of just four photographs—showing the overall habit of the tree, the leaves, the flowers, and the bark—to the entry in Fig. 3a makes a world of difference to community members. In the case of living organisms, photographs can also aid in the scientific identification of the named entity, through either the help of published field guides or collaboration with a professional biologist. For physical locations such as landscape or forest

types, a set of GPS coordinates allows the creation of maps that could aid linguistic and cultural revitalization efforts.

a) doḷḷi mara ದೊಳ್ಳಿ ಮರ — a kind of rainforest tree

b) doḷḷi mara ದೊಳ್ಳಿ ಮರ — a kind of rainforest tree, Careya arborea (Acanthaceae). The fruit, appearing at the start of the rainy season (April), is eaten in large quantities by elephants....

Figure 3. "Paralinguistic" information in lexical entries

4.3 LOOKING BEYOND THE LEXICON. During a routine interview, I asked an elderly consultant to describe a landscape type known as *oḍḍuga:ḍu* (Fig. 4). His response lasted a total of two minutes, but in that short space of time, he was able to detail the physical appearance of such a place (lots of large boulders piled one on top of another), place names where such a landscape might be found (*e:ru kallu, aḍkugallu*), the plants and animals that tend to be found in such a place (bears, tigers, porcupines, the *balla tale* plant), human interactions with such a landscape (going there to collect honey from a particular type of bee), and what might loosely be termed "cultural" information ("Our elders would tell us, 'Don't go to the *oḍḍuga:ḍu*! That's where bears live.'"). As it turns out, the consultant *had* ventured into such a dangerous place, and all the above information was delivered in the form of a lively account of how he was attacked by a bear on that occasion several years ago. Recording a story of this nature therefore serves the twin purposes of documenting not only naturalistic spoken language of a particular genre, but also important cultural and traditional knowledge encoded in the language. Such a recording captures vital information that cannot be obtained from, say, a list of medicinal plants or traditional foods—it captures the community's knowledge of very real ecological links between living organisms on the one hand, and between organisms and their natural environment on the other.

FIGURE 4. The landscape referred to as *oḍḍuga:ḍu*

Viewing the forest around them as a network of ecological relationships is something the Solega do unconsciously and very well, and it is worth documenting narratives that reflect this point. One could easily document descriptions of the different named forest types that the Solega recognize, but it would be a mistake to assume that such features of the landscape exist as discrete, unconnected entities in the Solega worldview. As shown in Fig. 5, two common forest types, the *guḍḍe ga:ḍu* 'hill forest' and the *maṭṭa ga:ḍu* 'flatland forest' are linked by animal migration patterns, resource availability, and seasonal cycles of water supply. In the dry season, when only the flatland creeks and ponds hold water, many animals, including elephants, prefer to remain on the flatland. This is also a time when yam tubers are ready for harvest, the above-ground parts of the plants having withered away. However, the Solega know that the flatlands are to be avoided at this time and prefer to harvest yams in the hill forests, because having one's attention focused on digging deep holes when there are thirsty elephants about can be a fatal experience.

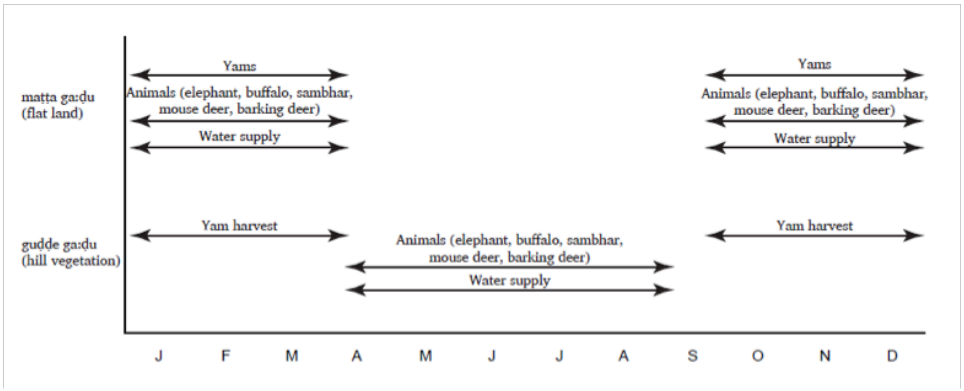

FIGURE 5. Ecological links between two forest types

Tree	Condition (26/03/09)						
	baḷḷu (bare)	eḷa:ku (new leaves)	ele (leaves)	muggu (buds)	hu: (flowers)	ka:yi (unripe fruit)	haṇṇu (ripe fruit)
matti	✓						
bejja	✓						
honne		✓					
aranelli		✓					
ka:ḍugeru	✓						
buḷuga		✓					
bu:ta:ḷe					✓		
i:raṇṇa	✓						
oluge	✓						
kagga:li	✓						
toṭṭi	✓						
anase			✓		✓		
sauravi:lu		✓					
kara:va:di			✓		✓		✓
kallicci			✓				
biḷicci			✓				
beṭṭasuṇḍe			✓				
bu:ra			✓				
udi:					✓		
kincaga					✓	✓	
araviḷu			✓		✓		
ke:silu			✓			✓	
torrema:û			✓	✓			
kaïyebe:u			✓		✓	✓	

FIGURE 6. Excerpt from the author's field notes showing traditional knowledge of the phenological characteristics of forest trees

While lacking knowledge of the western calendar of months (or even of any local Indian lunar calendars), the Solega are nevertheless keenly aware of annual seasonal cycles in their biotic and abiotic environment. The "rain calendar" described above is one such example—closely linked to this is the knowledge of plant life cycles (or "phenology") that practically every adult Solega can recall at will. Trees can be described in terms of around seven life stages, from "bare" to "bearing ripe fruit" (Fig. 6), and at any given moment, a comprehensive picture of "what the trees of the forest are doing" can be readily obtained. This "phenological calendar" is so internalized that Solega speakers will often describe other biological events in terms of the blooming of important forest trees. The following two examples describe how two honeybee species arrive in the B.R. Hills from the lowlands forests at different times of the year—these events coincide with the flowering of the *Pterocarpus marsupium* and *Indigofera* plants. For the Solega, such statements represent not only knowledge of an ecological link between a bee species and its preferred food source, but also a reliable indicator of biological cycles that are played out every year.

hejje:nu honne hu:.i -na ṭa:im bar-t-ade
A.dorsata Pterocarpus marsupium flower -GEN time come-NONPST-3sg.N
'The giant honeybee arrives in the time of the *honne* flower.'

kaḍḍi.je:nu maraḷi hu:.i-na ṭa:im bar -t -ade
A. florea Indigofera.sp. flower-GEN time come-NONPST-3sg.N
'The dwarf honeybee arrives in the time of the *maraḷi* flower.'

The changes that their home forest's ecosystem has undergone in recent decades have been observed with considerable sorrow by the Solega. The most obvious among these is the rampant growth of the weed *Lantana* through much of the forest, leading to the loss of many culturally important understory herbs, shrubs, and grasses. Solega elders display a keen understanding of the importance of having a diverse, healthy understory population structure, one that is maintained by regular burning. They describe how parts of the forest are now dominated by old trees, nearing the end of their lives, and *Lantana*, the latter also being responsible for the forest's loss of regenerative capacity:

> *I:ge:n a:gide? Marada taragu be:aida ottiga me:le ishṭu ga:tura bitta biddarue taragina me:leve, ondu bitta uṭṭa:geue da:ri ille. A:ga maḷe biḍta biḍta ni:ru biddu koḍte ottu, i:ga giḍa bardille. Saṇṇa giḍa ille, matte saṇṇa pairu illa matte e:n andare—ro:ja ma:tra. Jo:ra:goitu; arda mara gaṭṭa ue! … Marada geḍḍeka ni:re ille i:ga, be:re hotte:ve tindurtu adava. Mara ella oṇa:gitta biddiade. I: ka:lakka na he:ḷa:du, mara ella pu:ra oṇa:gi ottu, saṇṇa mara illa doḍḍa doḍḍa mara:de. I:vottu benki biddottu enda:ga, mara ella ta:ma:eya ho:tu i:ga.*
>
> What's it like now? When the leaf litter isn't burnt, all the seeds fall on the litter, and not a single one is able to sprout. And then the rain keeps falling on the seeds, and they all just rot. No small plants get to grow—just the *Lantana*. There's lots of *Lantana*; the bushes grow as tall as half a tree's height! … So now the trees' roots don't get any water, because the *Lantana* bushes drink it all. All the trees dry up, and fall over. I'm telling you, at the present moment, all the trees are drying up, and no new trees can grow, so the forest's full of big, old trees. And so when there's a forest fire, all the trees are destroyed.

This is an example of "new knowledge," and shows that TEK need not be confined to the traditions of the past. It is a constantly updated body of knowledge that evolves with the community's changing needs, observations, and preoccupations. It is therefore a worthwhile exercise to document community members' reactions to modern-day issues and challenges, as they have the potential to provide an insight into a world that may be irretrievably lost:

> *Ondu sari na:vu ka:ḍu benda:ga, minciga hu: andare gaṇava:da hu: buḍtittu a:ga, yelli no:ḍdare biri minciga hu:. Adu namma avaru—namma hengisaru—alli ho:da:ga avarige ishṭa bartittu, "idu ho:gu na:nu muḍiya be:ku," a:genta a: hu: muḍdu uṭṭu ka:ḍiga ho:gva:ga. I:ga hu: gaḷu ondu illa. A:ga da:rili ho:gta:idda:ga a: hu:ina ba:ri gamala bartittu… a:va:ga ka:ḍella pu:ra ondu tara gamala bartittu. I:va:ga a: gamala onduwe baralla*
>
> After you lit a fire, the fragrant minciga flowers would bloom; wherever you looked, there'd only be minciga flowers. Among our people—our women—they would want the flowers, [so you'd say to yourself,] "I need to go pick some," and you'd do so when going to the forest. You don't get any flowers now. Back then, while walking along a path, you could really smell the perfume of the flowers… the whole forest would smell like that. It doesn't anymore.

Regarding the forest as a network of ecological relationships often entails a detailed knowledge of each of the entities involved in that network. In the case of animals (and in particular, the animals that humans often interact with), this translates into a detailed understanding of animal behavior—this may include daily cycles of activity, migration patterns, foraging habits, and signs of aggression. The latter is particularly salient in the case of elephants, animals that are known to be frequently ill-tempered and unpredictable, and which are responsible for damage to crops and loss of human lives. Being able to accurately "read" the visual and auditory signals being given off by an elephant is therefore an indispensible part of being a Solega:

> *Ondu maravo: murritave, "bu:r" endave, ada hiḍiya bahudu. Matte kīvīya ondu taradalli "moṭṭakko moṭṭakko moṭṭakko" endu hoḍda:de. A: saddadalli hiḍitivī na:vu. Ondu ondu a:ne alli murda:de, adave: murda:de. "Kirri" enda:de, idalli "goḍrrr" enda:de, e:vadondu sadda koṭṭa:de. I: he:ḷu "boddo boddo boddo boddo" endu surda:de. A: tara nanaga gotta:gi "idu a:netta, be:re oṭṭo:gõ," enda:ki oṭṭo:itivī.*
>
> They'll shake a tree, you hear "bu:r," that's how you know. Then they flap their ears, making the sound *"moṭṭakko…moṭṭakko…moṭṭakko."* That's how we know they're there. The elephants trumpet, going "*kirri*" or "*goḍrrr*," one of those sounds. They make the sound "*boddo boddo boddo boddo*." That's how we know, "There are elephants here, let's go elsewhere," and we go away.
>
> *Ti:rtade ka:la, munga:la ti:rtavane avã, avã ro:puga:rã endu. A:ga na:vu tappisuma:ku.*
>
> It scrapes the ground with its foreleg, with its foot, to let you know that it's angry. That's when you need to flee.

As mentioned earlier, biological knowledge, culture, and religion often coalesce into a single belief system, and the Solega are no exception. The elephant, as a wild forest animal, is a manifestation of the Solega's elephant god, a:ne de:varu, who metes out punishment to wrongdoers while protecting the innocent:

> *Solapa inkura tappu sikkittu enda:ga a:ne elliddarue bandu uṭṭadde, avana se:rika.A:ga bandattu endale gedda:du gela:dondu avã sattale ondu, tappu bandale ma:tra. Tappu ille endu o:tu enda:ga alli biddurulue a:ne e:nu ma:ḍa:dille.*
>
> When an elephant detects even a bit of wrongdoing, it will turn up to meet [the offender], no matter where he is. Once it arrives, it may kill him, but only if he has done wrong. If he is innocent, the elephant will not do anything, even if he falls [while trying to run away].

4.4 AVOIDING BIASES. The goal of documenting TEK should be to create a record of indigenous perceptions and knowledge of the natural environment. It is easy, however, to fall

into the trap of merely translating western scientific knowledge into the target language, with the result that native concepts are incorrectly glossed, and native, possibly alien, ways of thinking are seen through the lens of a more familiar ontology. This is particularly true if the person carrying out the task of documentation has some biological training. This point has been succinctly argued by Pawley (2009), as follows:

> …a [good] dictionary should be an exercise in ethnography, the systematic description of a culture and society. Dictionaries deal with the conceptual categories and structures of a particular community, as encoded in its conventional ways of talking. In the case of a bilingual dictionary, the definitions of words and phrases in the source language (L1) should go beyond offering rough translation equivalents in the defining language (L2); they should try to capture the categories and structures of L1. This point should be self-evident but for bilingual dictionary-makers the temptation is always to take the short-cut and make do with glosses that are rough translation equivalents rather than definitions.

For instance, the Solega forest type *ka:nu ka:ḍu* is often glossed by field biologists visiting the region as 'evergreen forest' (a forest dominated by trees that do not shed their leaves, and contrasting with 'deciduous forest'). Ask a Solega person to describe a *ka:nu ka:ḍu*, and the following features are likely to be mentioned:

- always cold and dark
- occurs on the flat tops of hills
- a continuous stretch of forest
- has rivers with year-round water
- contains very large trees: *ha:le, thuruve, kakkilu, bikkilu, bellaḍe, ku:ma:ũ, kende, soravilu, aravilu, hebbe:u, aravilu kende, ne:ri, koḷa:ma, mi:na*
- few animals like to live there, especially in the rainy season: buffalo, civet, monkey, mouse deer, pangolin, porcupine

While both *ka:nu ka:ḍu* and 'evergreen forest' have identical real-world referents, it is interesting to note that the Solega do not characterize this forest type as one dominated by evergreen trees. They would no doubt agree, when asked, that the trees in the *ka:nu ka:ḍu* never lose their leaves, but that is not part of their mental representation of the term. To simply gloss *ka:nu ka:ḍu* as 'evergreen forest'—with little else by way of explication—would therefore be a distortion of the Solega's perception of this forest type, and an example of bad linguistic practice.

5. CONCLUSIONS. Biologists have, in recent years, come to realize that their conservation efforts will not succeed without the participation of local communities and the subsequent sharing of TEK. Linguists also need to initiate such cross-disciplinary studies, if they are to successfully conserve endangered languages. In the preceding discussion, I have argued that a substantial language documentation project that focuses on TEK can, in theory, be easily carried out. Naturally, no two speech communities are the same, but by eliciting material in the biological and ecological semantic domains, a documenter would be most

likely to record linguistic form and content that is of value to researchers and community members alike. A variety of factors often conspire to make TEK the most vulnerable part of a community's cultural and linguistic heritage, and in communities where this is found to be the case, the documentation of TEK should be made a priority.

REFERENCES

Anderson, Eugene, Deborah Pearsall, Eugene Hunn & Nancy Turner (eds.). 2011. Ethnobiology. Hoboken: John Wiley & Sons.

Aristotle. 1953. *Generation of Animals*. Harvard: Harvard University Press.

Baker, Brett. 2007. Ethnobiological classification and the environment in Northern Australia. In Andrea C. Schalley & Drew Khlentzos (eds.), *Mental States*. Philadelphia: John Benjamins Publishing Company.

Bakhtin, Mikhail. 1986. The problem of speech genres. *Speech Genres and Other Late Essays*. Austin: University of Texas Press.

Ban, Natalie, Chris Picard & Amanda Vincent. 2009. Comparing and integrating community-based and science-based approaches to prioritizing marine areas for protection. *Conservation Biology* 23. 899–910.

Becker, Dustin & Kabita Ghimire Kabita. 2003. Synergy between traditional ecological knowledge and conservation science supports forest preservation in Ecuador. *Conservation Ecology* 8. 1–11.

Berkes, Fikret. 1999. *Sacred Ecology: Traditional ecological knowledge and resource management*. Philadelphia: Taylor and Francis.

Berlin, Brent. 1972. Speculations on the growth of ethnobotanical nomenclature. *Language in Society* 1. 51–86.

Berlin, Brent. 1973. Folk systematics in relation to biological classification and nomenclature. *Annual Review of Ecology and Systematics* 4. 259–271.

Berlin, Brent. 1992. *Ethnobiological Classification*. Princeton: Princeton University Press.

Berlin, Brent, Dennis Breedlove & Peter Raven. 1973. General principles of classification and nomenclature in folk biology. *American Anthropologist* 75. 214–242.

Bulmer, Ralph. 1967. Why is the cassowary not a bird? *Man* 2. 5–25.

Bulmer, Ralph. 1974. Memoirs of a small game hunter: On the track of unknown animal categories in New Guinea. *Journal d'Agriculture Tropicale et de Botanique Appliquée* 21. 79–99.

Drew, Joshua & Adam Henne. 2006. Conservation biology and traditional ecological knowledge: Integrating academic disciplines for better conservation practice. *Ecology and Society* 11. 34–42.

Dwyer, Peter. 2005. Ethnoclassification, ethnobiology and the imagination. *Journal de la Société des Océanistes* 120-121. 12–25.

Ellen, Roy. 2004. Processing *Metroxylon sagu* Rottboell. (Arecaceae) as a technological complex: A case study from south central Seram, Indonesia. *Economic Botany* 58. 601–625.

Evans, Nicholas & Hans-Jürgen Sasse. 2003. Searching for meaning in the Library of

Babel: Field semantics and problems of digital archiving. In Linda Barwick, Allan Marett, Jane Simpson & Amanda Harris (eds.), *Researchers, Communities, Institutions, Sound Recordings*. Sydney: University of Sydney.

Gadgil, Madhav, Fikres Berkes & Carl Folke. 1993. Indigenous knowledge for biodiversity conservation. *Ambio* 22. 151–156.

Himmelmann, Nikolaus. 1998. Documentary and descriptive linguistics. *Linguistics* 36. 161–195.

Klubnikin, Kheryn, Cynthia Annett, Maria Cherkasova, Michail Shishin & Irina Fotieva. 2000. The sacred and the scientific: Traditional ecological knowledge in Siberian river conservation. *Ecological Applications* 10. 1296–1306.

Krupa, Viktor. 1996. Nature in Maori metaphor. *Asian and African Studies* 5. 14–27.

Maffi, Luisa. 2001a. Introduction: On the interdependence of biological and cultural diversity. In Luisa Maffi (ed.), *On Biocultural Diversity*. Washington: Smithsonian Institution Press.

Maffi, Luisa (ed.). 2001b. *On Biocultural Diversity: Linking language, knowledge and the environment*. Washington: Smothsonian Institution Press.

Martin, Gary. 1995. *Ethnobotany: A methods manual*. London: Chapman & Hall.

Nabhan, Gary. 2000. Interspecific relationships affecting endangered species recognized by O'Odham and Comcáac cultures. *Ecological Applications* 10. 1288–1295.

Nabhan, Gary. 2001. Cultural perceptions of ecological interactions: An "endangered peoples'" contribution to the conservation of biological and linguistic diversity. In Luisa Maffi (ed.), *On Biocultural Diversity*. Washington: Smithsonian Institution Press.

Nombo, Porer & James Leach. 2010. *Reite Plants: An Ethnobotanical Study in Tok Pisin and English*. Canberra: Australian National University EPress.

Pawley, Andrew. 2009. On the treatment of animal and plant names in bilingual dictionaries: Lessons from Oceania. *Eleventh International Conference on Austronesian Linguistics*. Aussois.

Ramstad, Kristina, N.J Nelson, G. Paine, D. Beech, A. Paul, P. Paul, F.W. Allendorf & C.H. Daugherty. 2007. Species and cultural conservation in New Zealand: Maori traditional ecological knowledge of Tuatara. *Conservation Biology* 21. 455–464.

Silvano, R. A. M. & A. Begossi. 2005. Local knowledge on a cosmopolitan fish: Ethnoecology of Pomatomus saltatrix. (Pomatomidae) in Brazil and Australia. *Fisheries Research* 71. 43–59.

Woolfson, Jonathan. 2009. The renaissance of bees. *Renaissance Studies* 24. 281–300.

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