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The Sustainability of Languages

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Abstract: The last several decades have seen a rapidly growing body of literature exploring shrinking linguistic diversity around the world and the efforts being undertaken to revive, revitalize or maintain the use of threatened languages. The controlling metaphor in this literature – that languages are species – has given rise to the concept of “endangered languages” and examinations of the link between biodiversity and linguistic diversity. Even so, the discourse of sustainability has not yet permeated this discussion. This paper explores the possibility of seeing languages as cultural resources that can be sustained by developing vibrant linguistic ecologies. We point out the implications of this view, as well as the benefits and obstacles to conceiving of language in this fashion. In this way, we build a framework for meaningful collaboration between the discourses of sustainability and endangered languages.

Keywords: Endangered Languages, Language Vitality, Linguistic Ecology, Evenki

THE LAST SEVERAL decades have seen a rapidly growing body of literature that explores the loss of linguistic diversity around the world, as well as the efforts being undertaken to revive, revitalize or maintain the use of local languages in areas where regionally dominant languages are encroaching on their use. The expression “endangered language” has become the conventional term in this literature to label those languages whose continued use in the next 100 years is questionable due to pressures on speakers to use other languages. The notion of an “endangered language” has proven to be felicitous in many ways, not least in raising public awareness about the reality of shrinking linguistic diversity. Just as the potential loss of a species raises the specter of consequential damage to other aspects of an ecology and the disappearance of a resource of possible benefit to humankind, so the loss of language might have similar negative outcomes. However, despite these benefits the controlling metaphor behind “endangered languages”--that languages are species--is not without its shortcomings. Human language is similar to a biological organism in only a limited fashion, and as a result, the expression “endangered language,” which is built on the analogy, can be misleading in ways that do not address the core dynamics that lead speakers to cease using the language of their heritage. The discourse of sustainability offers a promising alternative to depicting languages in biological terms. Rather than imagining languages as autonomous entities, this paper suggests treating languages as cultural resources that can be sustained by developing vibrant linguistic ecologies. We begin by providing a brief overview of the phenomenon of language endangerment and death, and we make explicit some of the problems that arise with the concept of an “endangered language.” We then introduce some benefits of a framework that casts languages in terms of *sustainability*: Language speakers are participants in and producers of dynamic linguistic ecosystems. We suggest that an ecologically oriented approach will help promote long-term linguistic sustainability, and perhaps be more beneficial to minority communities than ap-

proaches that single out a language system as an isolated object of revitalization or maintenance efforts. Finally, we conclude the paper with a brief case study of the Evenki community in Russia which illustrates the benefits of a sustainability perspective.

1. The Loss of Languages

It is not extreme to say that we are in the midst of one of the most pronounced demographic shifts in human history, a rapid transformation from a high level of linguistic diversity towards a relatively low level of linguistic diversity. The broad linguistic landscape that existed, say, 200 years ago is becoming harder to decipher in today's linguistic contours. The pockets of regional languages that peppered 18th century Europe have become fewer and farther between. The abundant indigenous languages of Australia, North America, China and Russia now go largely unheard by the majority populations of these regions after waves of 19th and 20th settlers have inundated their frontiers (Nettle & Romaine 2000). The need for oil, wood and minerals to fuel the economies of the world has opened up even the remote spots of the Amazon, South East Asia and Melanesia with an attendant disruption of linguistic patterns that have held sway for many centuries (Adelaar 1991, Matisoff 1991, Dixon 1991).

As a result, most experts agree that somewhere between 35%-50% of the estimated 7000 languages currently spoken in the world will cease to be used by anyone in the next century. Some, most famously Michael Krauss (Hale et al. 1992:7), have suggested an even greater percentage, as high as 90%. While the discrepancy in these predictions is somewhat disconcerting, it is perhaps understandable given the fact that only a handful of people have been examining the question of language disappearance, and this only in the last 20 years. Regardless of whether the pool of currently spoken languages shrinks by 35% or 50% or 90%, we are still looking at a substantial re-weaving of the tapestry of human language behavior. A language atlas in the year 2110 will be significantly less colorful than one from today.

Though there is some disagreement about the overall degree of impending language loss, there is basic agreement as to the causes of language moribundity and death. A language becomes extinct as a result of its speech community being decimated by war, genocide or disease, or because a regional or national government works to effect language shift, or because some set of circumstances leads members of a speech community to assign greater practical value to speaking a language other than the one that their parent and grandparents spoke. Such circumstances may be due to perceived economic advantages, the desire for greater social mobility, educational policies, or avoidance of social marginalization. How all this plays out in different regions of the world and in specific instances differs, but the general factors remain the same (Grenoble & Whaley 1998).

It is important to give some context to these predictions of language loss. First, we take it as axiomatic that human language and human interaction are such that language disappearance, as well as language appearance, are features of all eras. When members of a linguistic community are confronted with just the right combination of social factors, they may, over the course of time, cease speaking one language in favor of another. The language disappears, or goes extinct (to extend the "endangered language" metaphor) just so long as no other community on the globe is still speaking it. Yet it is also the case that human language is inherently dynamic. It necessarily changes over time. When language changes occur at different rates or in different ways within a linguistic community, we call these dialects. Over the course of time, these dialects may become distinct enough that they are properly labeled

separate languages. A language has appeared. These forces of language contraction and language expansion are everywhere present in human culture.

What is notable about our age, therefore, is not language disappearance per se, but the rate at which languages have been disappearing. Had a language map of Anatolia been drawn-up in 1300 BC, it would have included such languages as Hittite, Luwian and Palaic. However, all of these languages became extinct. People ceased speaking them, and the languages disappeared, presumably as the populations that spoke them became Hellenized. During the very same era that these many languages of Anatolia were becoming extinct, new languages were appearing around the globe. The Bantu migration and the peopling of Polynesia, as just two examples, were accompanied by a great deal of linguistic diversification. Bantu and Polynesian sub-dialects and dialects became more and more distinct as time and space separated the people that spoke them, and new languages were born. The rate of appearance of these new languages occurred more quickly than the disappearance of others. Therefore, while we can point to instances of language disappearance, the second millennium BC was a period of increase in the language diversity of the planet. In contrast, our age, perhaps without precedent, is one of rapidly shrinking diversity. To this observation, we should add another of equal importance. Not only is language disappearance outstripping language birth, it is also the case that this is true in every region of the world. This, we are quite sure, is without precedent.

There is another piece of contextualization that should be mentioned. Though language disappearance is an instance of demographic transformation of global and historic proportions, it is simultaneously invisible to most people. How do we reconcile these two facts? On the one hand, it should be noted that only a small proportion of the world's population has direct experience with language disappearance. As David Crystal (2000:14) has pointed out, 96% of the languages in the world are spoken by just 4% of the earth's people. In a real sense, the scope of language disappearance goes unnoticed because it is not obviously relevant to the way in which the vast majority of people inhabiting the earth go about their daily business. When the last speaker of a Californian language dies, few people in Palo Alto sense the ripples, let alone New Yorkers, Parisians or Muscovites. It is simply not on the proverbial radar screen.

This is not the whole explanation, however. There is another equally important dynamic at play. Except in instances of genocide, decimation of a speech community due to disease or radical displacement due to war, most instances of language disappearance occur slowly, over several generations. This fact often makes it difficult for individuals to recognize the degree to which patterns of language use are shifting in their community even though they may be fully aware of shifting patterns in their own family. They realize that, for example, they speak Spanish to their own children whereas their parents spoke to them primarily in Zapotec. Yet since Zapotec is still heard widely in the streets of their village, they are far less aware that overall the percentage of children using the language is dramatically on the decrease. In many instances of documented language obsolescence, perhaps even most, the tipping point at which the language started to move inexorably toward disappearance went unnoticed until it was nearly impossible to stop the process. In recent decades, there has been a fairly marked increase in the awareness of the reality of language disappearance by speakers of endangered languages, so perhaps this scenario will become less common. Even so, it helps us to understand why concern over language disappearance has lagged so far beyond the reality of the disappearance. The process itself is difficult to observe from within.

Moreover, cultural hegemony may limit community awareness of impending language death. Subaltern groups may be gradually led to believe that the marginalization of their language is in their own best interest. For example, parents or leaders in the minority community may elevate another language over their own heritage language, under the assumption that this path will lead to better opportunities for the younger generation, as Ladefoged (1992) and Dorian (1993) have discussed.

2. Is a Language an Animal?

The expression “endangered language” has become the conventional term by which to refer to a linguistic code that may cease to be spoken in the relatively near future. Borrowed from the world of ecology on the analogy of an “endangered species,” the phrase began to gain currency among linguists, anthropologists and others in the early 1990’s. Particularly important was a set of papers that appeared in *Language* in 1992, which served as a clarion call to the academic world to give notice to the reality of rapidly declining linguistic diversity.

The metaphor has proven to be an effective rhetorical strategy in terms of generating awareness about and concern for the long-term viability of many languages (Rivenburgh 2004). A public that is already attuned to the issues surrounding “endangered species” is able to sense in the parallel “endangered language” an urgency about the current status of languages in the world, even if the basis for such urgency is not made explicit. As Cameron (2007:270) nicely puts it: “The moral indignation about the plight of endangered languages is generated by linking the issue to ecological concerns about biodiversity.”

Rhetorical effectiveness aside, questions have been raised about the aptness of the metaphor for some time. As early as 1992 Dick Hudson prompted a discussion on the Linguist List about whether language death was really analogous to the extinction of a species (Hudson 1992). Taking a different tack, others (e.g. Cameron 2007) argue that the biological metaphor underlying “endangered languages” leads people to a moral concern grounded in diversity for diversity’s sake rather than a political concern based on human rights or social imbalances between different groups. For present purposes, we focus on three basic ways in which the “language is a species” metaphor is problematic.

First, when a species disappears, no instance of that animal is left. The biological organism no longer exists. The specific set of behaviors connected with the organism does not exist. The genetic material that combined to produce the animal has, for all practical purposes, disappeared. Is it the same when a language goes extinct? In one sense, yes. If no one on the planet speaks the Alaskan language Eyak as a first language anymore, then we might say that Eyak has disappeared from the cultural landscape of Alaska in the same way that the Moa is no longer found in New Zealand. You can’t hear fluent Eyak, and you can’t see a Moa. Both are gone in this sense. However, beyond this simple comparison, the analogy breaks down. Linguistic behaviors remain after a language goes extinct. People of Eyak descent are still using language, in this case, primarily English. Native Eyaks are still born with the biological endowment that drives them to learn a language just like everyone else. It will not be Eyak, but the disposition for language is still there.

Along these same lines, it should be noted that species extinction is ultimately abrupt. Though the population of an endangered animal usually goes into a steady decline until the point of extinction, when extinction occurs, the species is lost entirely. Language disappearance almost always is gradual. Even after the last native speaker dies, there are individuals

who understand and speak the language to varying degrees. That knowledge of the language gradually diminishes over time (often for the individual, and always across the population of non-native speakers), but this process takes some time. Even after a generation, there will be individuals that can at least produce phrases and sentences, even if extended discourse is no longer possible. This “lingering” effect has no obvious parallel in the biological world.

A second problem confronting the “language is a species” concept is that the potential causal relationship between the viability of one animal species to another does not hold for languages, at least not in the same fashion. The extinction of a certain animal (or plant) species can place another species at imminent risk because the survival of the latter depends on the former. Languages are not symbiotic in this way. While changes in circumstances surrounding a linguistic ecology (say, an explosion in the population of speakers on a particular language) may contribute to discontinued use of one (or more) of the languages in that ecology, the loss of that language will not *cause* the loss of another language. Nor will the loss of a language put the whole language ecology at risk of collapsing such that no language can survive.

The third, and perhaps most significant, challenge to drawing too close an analogy between a language and an animal is that there is no equivalent to multilingualism in the biological world. A species is relatively easy to define: the group of all individuals that can reproduce with other members of the appropriate sex within the same group. Cultural groups are far less bounded and far more fluid. Membership is hard to ascertain objectively. A given individual may simultaneously consider herself to carry several overlapping but distinct cultural labels (cf. Fought 2006). She may be Quichua, Ecuadorian, Catholic, indigenous and Latin American. Similarly, she may speak Spanish, Quichua and English. Multilingualism makes any close analogy to species hard to untangle.

At the heart of these observations lies the fact that language is not purely biological. It is also cultural. Yet it is also not purely cultural. Language depends crucially on both worlds, so a construct for an object of one kind—one from the natural world—fails for language at just those points where social practices and unique aspects of human community enter in.

There are two remaining issues, issues of a different sort, which should be raised before moving to a discussion on the reconception of “endangered languages” in terms of sustainability. First, the very concept of “endangered” often gives rise to a sense of exoticism. It is almost a tautology to say that “endangered species” are uncommon. They are creatures whose ecological niche is quite specific, so they are highly susceptible to changes in that ecology since, at least in many instances, they cannot adapt quickly enough to fill another niche. There is an analogy to be drawn with languages in this regard. Languages also depend on a niche. They are spoken in certain social domains, and when a new language encroaches on those domains, the original language can be driven out. However, the analogy fails beyond this basic observation because languages are *inherently* dynamic at a speed that species are not. Either through the productive processes that occur in every language system, or through borrowing from other languages, a specific language can adapt to changing circumstances almost immediately. This is a design feature of human language. Novel circumstances can be navigated and described.

Consider the following: In numerical terms, it is far less common for someone to know Shuar than Spanish. Is this because Shuar is only useful for living in the Ecuadorian rainforest? No. The fact that this is the region where Shuar is localized is a historical contingency rather than a consequence of the fact that the language has evolved in this niche and cannot survive

elsewhere. Certainly, it is true that there are vocabulary items that are nicely suited to the rainforest. However, these items could be dropped quickly and different items added if Shuar were to move into a new niche. This happens all the time in human language. Furthermore, with a different set of historical circumstances, Shuar could now be spoken over large swaths of South America. This hypothetical Shuar language would not be identical to actual Shuar in all ways. The hypothetical Shuar would reflect contact with a wider variety of languages. Perhaps it would have a slightly simpler morpho-syntactic structure since it would be likely to be used as a lingua franca. It would certainly have a different lexicon. However, it would still, unmistakably, be Shuar. Here again languages are transportable across space in ways that many species simply are not. Alpacas, narwhals, and ringed-tailed lemurs have a dependency on their ecological niche for survival. They are exotic in that sense. But the Shuar people and the Shuar language, though “unusual” in purely demographic terms, are not exotic in the same way. When people come to see them as such, this may actually *undermine* efforts to create a context in which the language is sustainable in the longer run.

A final issue that we must consider in using the term “endangered language” is that the underlying metaphor sometimes leads to specious claims about the link between biodiversity and linguistic diversity. Here is just one example:

The threat to multilingualism is similar to the threat to biodiversity. Not just because most languages are like disappearing “species”, but because there is an intrinsic and causal link between biological diversity and cultural diversity. Like plant and animal species, endangered languages are confined to small areas. More than 80 percent of countries that have great biological diversity are also places with the greatest number of endemic languages. This is because when people adapt to their environment, they create a special stock of knowledge about it which is mirrored in their language and often only there. Many of the world’s endangered plant and animal species today are known only to certain peoples whose languages are dying out. As they die, they take with them all the traditional knowledge about the environment (Bjeljac-Babic 2000).

The correlation between regions of high biodiversity and high linguistic diversity is well known (e.g. see Nettle & Romaine 2000 for a discussion), and it is well-established that specialized knowledge of a local environment is transmitted through language, sometimes in ways that are only clumsily translated into other languages (Harrison 2007). These claims, however, are a far cry from an “intrinsic and causal link” between language and the natural environment. Indeed, we are unaware of any instance in which the death of a language has led to the extinction of a species, so it is hard to take seriously the statement, “the threat to multilingualism is similar to the threat to biodiversity.”

3. Using the Discourse of Sustainability

Rather than conceptualizing language as a species, we find it more meaningful and accurate to conceive of it as a valuable cultural resource situated in a particular ecological relationship with other languages. In what ways is it proper to describe language as a resource? Most obviously, language provides a remarkably sophisticated and effective means by which people can communicate. This trait is true of language generally. There are also a variety of ways that a specific language can be properly said to be a resource. 1) Language helps to

define a society and give the society its character. In multilingual societies, it is the aggregate of languages which serves this purpose. 2) Language is a basic mechanism for establishing individual and cultural identity. 3) Language helps to draw a link between place and history (Basso 1996). This is most trivially seen in such things as place names, but we have in mind something much more profound. Humans typically have an attachment to their heritage, and this heritage comes to them through traditions, language and connection to specific spaces. 4) Language is a window to knowledge systems (Maffi 2001). Different languages and cultures represent different ways of tackling reality, and hence are an indispensable source of insight in the non-necessary character of our own respective ways; our limited understanding should inspire some modesty and respect. 5) Diverse languages provide greater understanding of the range and diversity of human language itself (Harrison, Rood & Dwyer 2008).

As a cultural resource, language is, most obviously, used by its community of speakers, both for purposes of interlocution and as a marker of group and individual identity. A specific language, however, should also be seen as a resource for the non-speakers in the community. It provides relatively easy access to a novel linguistic code as well as the perspectives on the world contained therein. Language is a shared community resource for speakers and non-speakers in another way. It allows individuals to connect to a heritage that transcends their present--something which is important to individual and group flourishing. Like natural resources, cultural resources such as language play a vital role in human well-being.

Seeing language as a valuable cultural resource requires us not only to consider language in current *use*, but its sustainability over time. Just as natural resources must be managed in such a way to make their enduring utilization possible, so language resources must be managed to provide for continued use in future generations. This means a proactive nurturing of social domains in which the language will be applied: education, religious rituals, commerce, extra-community interaction, politics, and so on.

Moreover, understanding language as a resource brings us to recognize that languages have local ecologies and that these ecologies interact with and are affected by other language ecologies. We draw an analogy, then, between biological ecosystems and linguistic ecosystems: Both are characterized by interaction and dynamism. With respect to the “dynamic processes” found in biological ecology, Lopez-Zent & Zent report that “the previous view that tropical forest biomes are pristine relics...is being overturned in favor of a view that stresses considerable biological heterogeneity over space and time” (2004:80).

Dynamic interactivity is the norm in cultural/linguistic processes as well (Johnstone 2004:72, Street 1991, Barth 1969, 1981, cited in Coupland 2007:106). From the perspective of sustainability, language speakers are continually produced by -- and producing -- the surrounding cultural/linguistic ecologies. The sustainability approach can therefore draw strength from these organic processes. After all, it is easier to guide the flow of a river than to directly stop its current. With that in mind, the language revitalization movement could focus on finding ways to positively and organically guide the natural dynamism and interplay of languages, rather than attempting to freeze a language with respect to a supposed earlier “untouched,” “pristine” static existence.

Having suggested that language revitalization be reframed around the metaphor of sustainability and ecological systems, we can now highlight the potential benefits of this approach. First, one benefit of the discourse of sustainability is that it continues to draw a link between climate, natural resources and language use. This was one of the benefits of the metaphor “endangered language” as well. Secondly, the discourse of sustainability approach draws

attention to language as a social action rather than an object, thereby harnessing the natural processes of change and human agency, a strategy that has been well tested in social theory (e.g., Giddens 1979, Fairclough 1989). Thirdly, the sustainability approach views languages as cultural resources that can be sustained by developing vibrant linguistic ecologies. This approach also draws attention to the fact that every language has a local ecology that is affected by larger ecologies. Such a perspective more closely matches the reality of these relationships and therefore leads to greater efficacy and long-term benefits for all of the affected ecologies.

4. The Relationship between Climate Change and Language Vitality

In this section, we explore the relationship between climate change and language vitality by presenting a brief case study of the Evenki language of Russia. Despite a population of approximately 30,000, in 1989 only 30% of that population considered Evenki to be their first language, and the percentage is clearly even lower today. The language remains vital only in villages where Evenki live in relatively dense groups and maintain a traditional lifestyle, including reindeer-herding. Evenki is used most frequently in such villages because children participate with adult Evenki speakers in the activity of reindeer-herding—this is an Evenki space (Grenoble & Whaley 1999).

Seeing Evenki through the lens of a sustainability approach highlights the fact that biological and social well-being in the Evenki local ecosystem have some connections to language. First, we note that Evenki reindeer herders in Russia derive almost half their calories from meat, more than twice the amount consumed by the average American, yet Evenki men are leaner and have cholesterol levels that are 30 percent lower than the levels of American men (Leonard et al. 2002). It turns out that the meat from reindeer and other free-ranging animals is less fatty, and lower in saturated fats, than meat from cattle and other feedlot animals. What's more, these herders appear to have a naturally higher metabolic rate than American males (Leonard et al. 2002).

Now consider the effects of dramatic climate changes in this ecosystem (Jernsletten & Klokov 2002, Phoenix & Lee 2004, Moen 2008). Reindeer (as well as caribou) have evolved to exploit an energy-rich winter lichen diet, making reindeer well suited for their cold environment. The lichen is largely obtained by cratering under the snow, and reindeer-herding therefore requires mobility and access to taiga-tundra transition areas. However, recent warming has resulted in a dramatic increase in the number of days of above-freezing temperatures during the migration period in most of the circum-polar region, creating many thaw-freeze cycles with icy upper layers forming in the snowpack. These icy layers make it harder to crater for food, often resulting in shrinking herds and lower rates of reproduction. Widespread degradation of permafrost has been shown in numerous studies, and the taiga forests are expanding into the tundra.

The situation is further complicated by human activities that have led to ecosystem degradation in this area. Southward displacement of the tundra/taiga boundary has been reported due to human disturbance and increasing waterlogging, which has led to the death of treeline trees. Oil exploration and infrastructure development are encouraged by these climate changes, which further causes degradation to the taiga/tundra balance (Truett & Kertell 1992).

As reindeer confront these rapid changes to their habitat and lifestyle, the human population is deeply affected as well. The loss of reindeer-herding has been socially very disruptive for

the Evenki. Many now face unemployment, and the change in diet has led to an increase in diabetes and obesity.

There are potential solutions to the reindeer-herding problem, such as developing different means of subsistence or different methods of reindeer-breeding, or even relocation. All of these options are socially disruptive. All of them would likely have an effect on the Evenki language, just as Evenki language use and language attitudes can affect the ecosystem as well. For example, increased attention to the heritage language (such as an aggressive revitalization program) might bring more attention to traditional lifestyles, values, and identity. Perhaps some Evenki might then strive to maintain a clearer “Evenki identity” in the face of challenges to their traditional lifestyle. A strong Evenki language movement and ethnic identity could influence some Evenki to choose to remain in relatively dense social groups, rather than dispersing among non-Evenki groups. This in turn would have an effect on Evenki decisions about their traditional lifestyle, livelihood, and local responses to climate change – all of which can affect the reindeer and many other aspects of the ecosystem.

Although these possible outcomes are just hypothetical in the Evenki case, the dynamics of biology, climate, language, and lifestyle are all contemporary Evenki realities which need to be recognized. Suppose that a heavily funded Evenki language revitalization project ignored all of these urgent social, climatological, and biological issues. Besides neglecting some of the most pressing perceived needs of the Evenki themselves, the linguistic project would have little chance of success if economic conditions forced the Evenki to leave the dense social networks in their homeland, dispersing and integrating into Russian society with all of the concomitant changes in occupations, lifestyles, and, of course, language.

In this way, the Evenki case shows how language is closely integrated with multiple interacting social, biological, economic, and climatological issues confronting an ecosystem. It would be wise to carefully and holistically coordinate language revitalization efforts with multifaceted aspects of the local ecosystem rather than only focusing on narrow linguistic issues. As Romaine (2008:19) has noted, “In discussions of language maintenance, revitalization, and so on there is a tendency to reify languages, when it is communities and language ecologies we should be talking about... [languages] are vital parts of complex local ecologies that must be supported if global biodiversity is to be sustained” (cf. Bastardas-Boada 2005:3).

5. Conclusion and Future Directions

Traditional approaches to language revitalization tend to focus on a single language, directing most of the research effort and grant allocation toward relatively narrow targets of linguistic research and activism. By contrast, a sustainability approach would call for a wide-ranging, holistic, pluralistic, team-oriented, community-conscious design. Ideally, the initial impetus for the project would come from within the community itself (Grenoble & Whaley 2006). Researchers would then begin to chart the interacting spheres of the ecosystem: biology, climate, geography, agriculture, economics, politics, history, anthropology, sociology, sociolinguistics, linguistics, and others. The team would draw from professional specialists and as many local community members as possible at all levels of the project, including project leadership. Specific plans could then be implemented to support and guide the natural dynamics of the overall ecosystem, i.e., long-term sustainability -- including but not limited to linguistic sustainability.

On the surface, the sustainability approach may seem like a rather daunting task. It is considerably more complex and wide-ranging than traditional approaches to language revitalization. Yet the greater complexity of this process merely reflects realities in the ecosystem which need to be addressed. In this way, the sustainability approach promises significantly greater long-term success since it sets out to engage with the whole ecosystem, rather than unnaturally extracting one element above others. We believe, therefore, that the benefits of a sustainability approach are well worth the effort.

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