*Ecological Applications*, 17(6), 2007, pp. 1742–1751


# A CROSS-REGIONAL ASSESSMENT OF THE FACTORS AFFECTING ECOLITERACY: IMPLICATIONS FOR POLICY AND PRACTICE

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*Abstract*. The value of accumulated ecological knowledge, termed ecoliteracy, is vital to both human and ecosystem health. Maintenance of this knowledge is essential for continued support of local conservation efforts and the capacity of communities to self- or co-manage their local resources sustainably. Most previous studies have been qualitative and small scale, documenting ecoliteracy in geographically isolated locations. In this study, we take a different approach, focusing on (1) the primary factors affecting individual levels of ecoliteracy, (2) whether these factors shift with economic development, and (3) if different knowledge protection strategies are required for the future. We compared non-resource-dependent communities in the United Kingdom with resource-dependent communities in India and Indonesia ($n = 1250$ interviews). We found that UK residents with the highest levels of ecoliteracy visited the countryside frequently, lived and grew up in rural areas, and acquired their knowledge from informal word-of-mouth sources, such as parents and friends, rather than television and schooling. The ecoliteracy of resource-dependent community members, however, varied with wealth status and gender. The least wealthy families depended most on local resources for their livelihoods and had the highest levels of ecoliteracy. Gender roles affected both the level and content of an individual's ecoliteracy. The importance of reciprocal oral transfer of this knowledge in addition to direct experience to the maintenance of ecoliteracy was apparent at all sites. Lessons learned may contribute to new local resource management strategies for combined ecoliteracy conservation. Without novel policies, local community management capacity is likely to be depleted in the future.

*Key words: ecoliteracy; India; Indonesia; knowledge; natural resource; oral traditions; resource management; sustainable management; United Kingdom.*

## Introduction

For as long as humans have relied upon natural resources, we have been stockpiling a wealth of place-based knowledge by engaging in hunting, gathering, fishing, and farming (Pretty 2002). This knowledge has been transferred as a survival tool between consecutive generations by traditional practices, stories, and songs (Peat 1996, Alexiades 1999, Wenzel 1999, Turner et al. 2000, Brodt 2002). Those that acquire this knowledge can be described as being ecoliterate: they are able to identify local plants and animals, name their uses, and tell stories about them. Thus, we define ecoliteracy as a cumulative knowledge base that describes local ecosystem components and their interactions most commonly derived from a pool of accumulated observations (Gadgil et al. 1993, Pierotti and Wildcat 2000, Davis and Wagner 2003).

This tacit form of knowledge is different from Western science, and generally goes unrecorded throughout history, and consequently is often considered inferior (Gadgil et al. 1993, Scoones and Thompson 1994, Young 2002). However, by going unwritten, ecoliteracy is dynamic, adaptive (often tested in resource-dependent societies on a daily basis [Alexiades 1999, Roth 2004]), and current, thus coevolving with the ecosystem in question (Scoones and Thompson 1994, Berkes et al. 2000, Young 2002, Long et al. 2003, Ekpere 2004, Pacón 2004, Rahman 2004). This is key where ecosystems are constantly evolving due to a combination of synergetic drivers. These include resource scarcity, changing market opportunities, policy intervention, loss of adaptive capacity, and changes in social systems (Ojima et al. 1994, Lambin et al. 2001, Lambin et al. 2003).

Ecoliteracy as a knowledge base offers some solutions to local, national, and global environmental challenges by providing information on the use of locally available resources (King 2003, Kaushik 2004, Hassan et al. 2005, Media Ecology Association 2005). It offers economic benefits, food security, medicinal solutions, and cultural continuity to both communities and nations, whilst retaining the promise of future discoveries (Gadgil et al. 1993, Pfeiffer 2002, Shrestha and Dhillion 2003, Hamwey 2004, Le Quy 2004, Mhame 2004, Ruiz Muller 2004, Zhang 2004, Media Ecology Association 2005). These are just some of the reasons behind the work of

Manuscript received 8 October 2006; revised 9 February 2007; accepted 20 February 2007. Corresponding editor: W. V. Reid.

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groups such as Terra Lingua and Cultural Survival, who advocate for the widespread protection of ecoliteracy (King 2003; Cultural Survival web site [*available online*]).[2]

Arguably, the most important derivative of ecoliteracy is the range of sustainable resource management practices that have evolved from it. The importance of these practices in advising biodiversity conservation policies and management strategies has only recently been described (Agrawal and Gibson 1999, Posey 1999, Berkes et al. 2000, Ruddle 2000, Turner et al. 2000, Olsson and Folke 2001, Samson 2002, Rudd et al. 2003, Folke 2004, Olsson et al. 2004, Drew 2005). These practices and the communities they have emerged from have enhanced and protected seed variety and genetic diversity for agriculture and international food security for generations (Mauro and Hardison 2000, Pretty 2002, Sahai 2004, Tansey 2004, United Nations Development Programme 2004). (However, it is important to note that not all traditional management practices have been environmentally sustainable and when combined with poor policies, institutional support, and ownership rights, a number have led to local species extinctions [Gadgil et al. 1993, Murdoch and Clark 1994, Sillitoe 1998, Gilchrist et al. 2005].)

Since effective sampling of all of the world's ecosystems is impossible, management practices imposed in state systems are often based upon conceptual theory of sustainability combined with periodic surveys rather than generations of observations. The synthesis of local knowledge on site permits anticipation and rapid response to sudden environmental shifts, unlike state theory, whereby changes are only detected when they reach large-scale shifts (Feit 1988, Lundquist and Granek 2005). For as long as governments continue to view traditional folklore as an obstacle to resource management rather than a tool, state management systems will most likely fail (Dove 1988, Rudd et al. 2003).

Producing generation after generation of ecoliterate individuals is likely to have been necessary for the survival of our ancestors, and still is to many rural poor and indigenous groups (Kellert and Wilson 1993, Ghimire and Pimbert 1997, Salmon 2000, LaRochelle and Berkes 2003, Pyle 2003, Fenta 2004). However, ecoliteracy is not exclusive to resource-dependent communities and is also present in developed regions (Olsson and Folke 2001, Olsson et al. 2004). This emphasizes the importance of placing each knowledge base within its sociocultural, political, and ecological setting. Although this idea has been touched upon many times (Wenzel 1999, Brodt 2002, Davis and Wagner 2003, King 2003), very few studies have addressed the impact of these broad factors upon knowledge acquisition. Most research has been too small scale, culturally specific, and geographically localized to consider this dimension (Sillitoe 1998).

Despite its importance, the loss of ecoliteracy has also been well documented in recent years (Nabhan and Trimble 1994, Gadgil et al. 2000, Turner et al. 2000, Pyle 2001). Numerous mutually reinforcing large-scale processes have been identified as causes of ecoliteracy decline, including urbanization of traditional societies (Nabhan and Trimble 1994, Young 2002), Westernization of public services, technologies and belief systems (Nabhan and Trimble 1994, Peat 1996, Johnson 2000, Pyle 2001, Tansey 2004), and globalization of trade leading to local product commercialization (Gadgil et al. 2000, Byg and Balslev 2001, Hamwey 2004). Although credible, these causes are broad and indirect. What are the direct factors that reduce the number of ecoliterates within a community? For instance, building infrastructure does not automatically erase ecoliteracy. However, urbanization as an ongoing process may lead to a reduction in the number of people working on the land and loss of green spaces, which may in turn lead to ecoliteracy decline (Johnson 2000). Knowledge of these factors is essential to our own understanding of ecological knowledge decline, as well as to policy makers with a view to conserving ecoliteracy, since wide-scale processes such as urbanization are unlikely to be reversed.

Previous research has generally targeted isolated areas and qualitatively documented local knowledge (Gadgil et al. 2000, Vandebroek et al. 2003, Roth 2004, Ghimire et al. 2005, Singh et al. 2006). In the light of this and the current lack of understanding of ecoliteracy decline, we have to consider (1) the primary factors affecting ecoliteracy acquisition, (2) whether these shift with economic development that is inevitable in the future, and (3) if different protection strategies are required to cope with this shift. Therefore, this research is novel in its attempt to understand whether any common factors, such as effective transfer methods (e.g., oral transfer and formal schooling), exist between communities with differing levels of both resource-dependence and sociocultural and political frameworks. It is hypothesized that the factors affecting ecological knowledge will be different based on social, cultural, and economic differences (Wenzel 1999, Brodt 2002, Davis and Wagner 2003, King 2003). This cross-cultural study also sought to assess the importance of these factors quantitatively, in order to isolate those with the greatest potential for use in knowledge-protection policies in the hope of heightening local management support globally (Hassan et al. 2005).

Four levels of ecological knowledge have been recognized (Berkes 1999): (1) the names of living (e.g., plants, animals) and physical (e.g., soils, water, weather) components of ecosystems; (2) the functions and uses of each component; (3) the land and resource management systems and the social institutions that govern them; and (4) the worldviews and cosmologies that guide the ethics

[2] ⟨http://www.cs.org/⟩

of people in the system. In this study, we analyzed the first two levels of ecological literacy focusing on the knowledge of local species and resources, rather than knowledge of dynamic ecosystem processes that are managed to generate goods and services. Therefore, this research only captures part of the ecoliteracy issue, but addresses it in detail. The cross-cultural comparisons made in this study would not have been possible if considering knowledge of ecosystem processes as explanations differ between regions ranging from compartmentalized and scientific to holistic and spiritual. Therefore, these results do not necessarily reflect the situation for other levels of ecological knowledge.

## Methods

### *Site selection*

The factors affecting ecoliteracy at sites in the United Kingdom were assessed and compared with those at Indian and Indonesian study sites. Rural, suburban, and coastal sites were sampled at both the resource-dependent (India and Indonesia) and non-resource-dependent (UK) sites for a fair comparison to be made. We selected sites according to the following criteria: (1) They were accessible and segregated into smaller subpopulations (villages/wards) for representative subsampling; (2) local resources were not under any exclusion legislation and therefore could be used as common property; (3) residents of the UK study sites were historically resource reliant, and residents of resource-dependent communities were still resource reliant; and (4) in resource-dependent regions, we could be supported by local NGOs/organizations who had established relations of trust with local communities and knowledge of cultural taboos.

Within the United Kingdom, respondents from four villages in rural Lincolnshire, four suburban wards of south London, and three maritime towns on the East Anglia coastline were interviewed between April 2004 and March 2005. The UK sites selected were indicative of communities no longer dependent on local natural resources, but instead reliant upon imported goods. They were chosen to be representative of other industrialized regions with a stable economy and food supply largely grown outside of the region. Very few livelihoods retained traditional connections with the land. Even the farming techniques of rural Lincolnshire had moved away from traditional practices and now focus on monocropping (Department for Environment, Food and Rural Affairs [DEFRA; information *available online*],[3] D. Rose, *unpublished manuscript*).

In these areas, local ecoliteracy is crucial for continued public support of local land management and biodiversity protection schemes, as people are unlikely to care about that which they do not know (Matsumoto 2003, Lundquist and Granek 2005). Without local support, local practices are unlikely to be sustainable (e.g., the removal of hedgerows and the loss of field margins), local green spaces are not likely to be cared for and protected, and local population monitoring unlikely (Olsson and Folke 2001, Olsson et al. 2004). Therefore, the majority of local species extinctions will go unnoticed and unabated.

The Indian data were collected on two site visits during January 2003 and July–August 2003. Within India, four rural villages and one suburban village (on the outskirts of Madurai) were sampled from the Virudhunagar district in Tamil Nadu, southern India, with the support of a local NGO, SPEECH (Society for People's Education and Economic Change). The Indonesia data were collected on a field visit carried out between July and September 2005. Within Indonesia, two coastal and three rural villages were sampled on the island of Kaledupa in the Wakatobi National Marine Park, southeast of Sulawesi, with the support of the conservation organization Operation Wallacea.

We selected sites from India and Indonesia that were representative of traditional resource-dependent communities under emerging assimilation pressures. Traditional systems of management in these areas have remained largely unaltered for generations, with many livelihoods continuing to be subsistence based (Cairns 2001, Tamil Nadu Agriculture Department 2005). Both have suffered from persistent food insecurity and widening gaps between the rich and poor (Glaeser 1995, Indonesia Human Development Report 2001, Tamil Nadu Human Development Report 2003). Recent development pressures that have emerged at the sites include market expansion and the introduction of schools and Western medicine (Scoones et al. 1992, Tamil Nadu Human Development Report 2003).

Thus, social processes such as modernization, urbanization, and globalization are only just unfolding at the resource-dependent study sites. This enables a comparison to be made of the factors affecting ecoliteracy at differing stages of economic development. Maintenance of ecoliteracy is essential to sustaining traditional resource management practices and self-management capacity at the resource-dependent localities (Feit 1988, Drew 2005). Here, ecoliteracy is integral to local economics, cultural values, social structure, and worldviews. By comparing sites distanced in culture, history, trade relations, and relationships to the land, this study tests for any underlying factors key to ecoliteracy acquisition.

### *Interviews*

Quantitative ethnobotanical and ethnozoological interviews were used to identify the factors that make one person more knowledgeable than another. We used species flashcards in interviews based on previous studies by Balmford et al. (2002) and Nyhus et al. (2003). This method was employed not as a complete measure of

[3] ⟨www.defra.gov.uk/erdp/docs/sechapter/section11/topography.htm⟩

overall ecoliteracy, but as an effective tool for making an assessment of the most and least knowledgeable groups over large sample sizes (Nyhus et al. 2003).

Species flashcards consisted of a selection of local wild plant and animal species. For the different study sites, we collated lists of common local species using different sources. For the UK study sites, DEFRA records were used to collate a list of 86 species (Department for Environment, Food and Rural Affairs, *available online*).[4] For the collation of 48 south Indian species, Kew Gardens' SEPASAL (Survey of Economic Plants for Arid and Semi-Arid Lands) database was used (Royal Botanical Gardens Kew, *available online*).[5] For Indonesian species collation, a number of scientists familiar with the ecology of Kaledupa were consulted to formulate a list of 72 common species. All species lists were verified by a selection of local experts recommended by local NGOs/research organizations on site.

Respondents were asked to name all species shown to them and list any uses. Local translators were used at the India and Indonesia study sites. Species-naming ability acts to validate and measure the abstract concept that is ecoliteracy and has been used successfully in a number of other studies (Dixon et al. 2005, Evans et al. 2005). In addition to identifying local plants and animals, we asked respondents how frequently they visited the countryside, the primary source of their environmental knowledge, and where they grew up.

Respondents in the United Kingdom were asked to categorize their mean household income. At the Indonesia and India study sites, income was highly seasonal and thus harder to define. Therefore, at the India study site, wealth was ranked using a point-scoring system based on village status and material wealth (Pretty et al. 1994). At the Indonesia study site, data from in-depth economic surveys were used that summarized mean village income (Smith et al. 2007). Demographics including age, gender, and area of residence were also recorded. Interviews for all sites were first tested with pilot populations. Wherever possible, we interviewed respondents in private away from third parties who may have acted to influence respondents' answers (Holstein and Gubrium 1995, Houtkoop-Steenstra 2000).

### *Sampling*

Previous ecoliteracy studies have focused upon identifying experts, and few have taken widely utilized community knowledge and practices of laypersons into account, despite their known contribution to local resource management (Davis and Wagner 2003). Limited sample sizes are another shortcoming of many earlier studies (Alexiades 1999, Martin 2004). In this study, large sample sizes ensured that all voices were heard (including women, children, and the rural poor) using stratified cluster sampling as the basis for respondent selection.

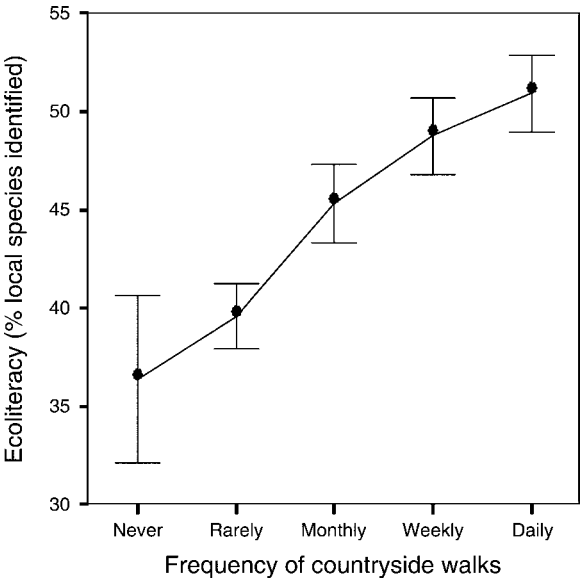


FIG. 1. Comparison of the ecoliteracy (mean ± 2 SE, $n = 646$ respondents) of groups of UK respondents that visit the countryside at different frequencies.

Cluster sampling was used to select a random sample of villages within the chosen locality. Then, stratified sampling took place within the villages, ensuring that all subpopulations (men and women of each age group) were represented at a ratio that reflected their proportions within the actual population. Thus, designated quota sizes were pre-determined and statistically viable according to Roscoe (1975), with the minimum age of respondents being 15 years. We used purposive sampling methods, including door-knocking and chain referrals or snowball sampling, a method frequently employed in this field (Huntington 2000, Brodt 2002, Davis and Wagner 2003). In total, 906 interviews were carried out within the United Kingdom (178 rural, 241 suburban, and 227 coastal) compared with 344 interviews within Indonesia and India (178 rural, 18 suburban, and 64 coastal).

The SPSS 11.0 package (SPSS 2001) was used for database construction and for the handling, analysis, and manipulation of data (Kinnear and Gray 1999). We used nonparametric statistical tests to provide a more conservative result when analyzing non-normally distributed data. The effect of gender on ecoliteracy was assessed using Mann-Whitney $U$ test. We used Spearman's rank to test for an association between ecoliteracy and wealth. All other comparisons were made using Kruskall-Wallis.

[4] ⟨http://www.defra.gov.uk/environment/statistics/index.htm⟩

[5] ⟨http://www.kew.org/ceb/sepasal/sepaeng.htm⟩

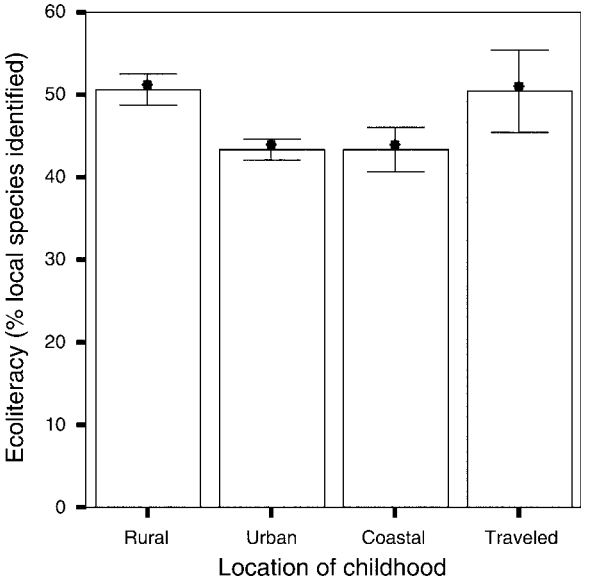


FIG. 2. Comparison of levels of ecoliteracy (mean ± 2 SE, $n$ = 646 respondents) between groups of UK respondents from four different childhood environments.

## RESULTS

### *UK results*

In the United Kingdom, the frequency with which an individual visits the countryside was found to be the most important factor affecting ecoliteracy (Fig. 1). A direct relationship was found between knowledge level and frequency of visits ($H = 90.065$, df = 4, $P < 0.001$). Groups of people who visit the countryside on a daily basis were able to identify on average 15% more local species than non-visitors.

Area of residence was found significantly to affect ecoliteracy ($H = 34.324$, df = 2, $P < 0.001$). Residents of rural areas were able to identify on average between 6% and 7% more local species than coastal and urban residents, respectively (rural, 51% ± 2.0%; urban, 44% ± 1.4%; coastal, 45% ± 1.8%).

Area of residence during childhood was found to significantly affect an individual's ecoliteracy level ($H = 41.340$, df = 3, $P < 0.001$; Fig. 2). The data revealed that people who spent their childhoods living in rural locations or who traveled around were able to identify 8% more local species on average than those who grew up on the coast or in towns and cities.

Finally, the primary knowledge source was found to significantly affect the level of a person's ecoliteracy by up to 14% ($H = 50.496$, df = 7, $P < 0.001$; Fig. 3). Respondents with the highest ecoliteracy levels acquired it from parents and relatives, environment-based occupations, and hobbies. Respondents that acquired their ecoliteracy primarily from television and schooling were the least competent at identifying local plant and animal species. Books were found to produce intermediary levels of ecoliteracy.

Gender and income level were both found to have no impact upon ecoliteracy level at the UK study sites.

### *Indonesia and India results*

At all resource-dependent study sites, knowledge was found to be inversely related to wealth. Use knowledge was found to significantly decrease with increased household income at the Indonesia study site ($r_s = -0.319$, $P < 0.01$; Fig. 4a). At the India study site, both use knowledge ($r_s = -0.419$, $P < 0.05$; Fig. 4b) and overall ecoliteracy ($r_s = -0.610$, $P < 0.01$; Fig. 4c) significantly declined with increased wealth rank.

At the resource-dependent study sites, gender was also found to affect ecoliteracy level and content. At the Indonesia study site, men had significantly higher levels of ecoliteracy than women ($U = 2188.000$, $P < 0.05$; men, 75% ± 2.2%; women, 72% ± 2.1%).

At the India study site, no gender differentiation in total ecoliteracy levels was found; however, the data showed that Indian men knew more livestock uses for local species ($U = 28.500$, $P < 0.01$; men, 10 ± 2.4 uses; women, 5 ± 1.4 uses) and elder women knew more health uses ($H = 13.555$, df = 3, $P < 0.01$; Fig. 5).

Area of residence, location of childhood, and knowledge source were all found to have no effect on knowledge at the resource-dependent sites. Frequency of visits was not assessed at these sites since ecosystem interaction for the majority of respondents was on a daily basis.

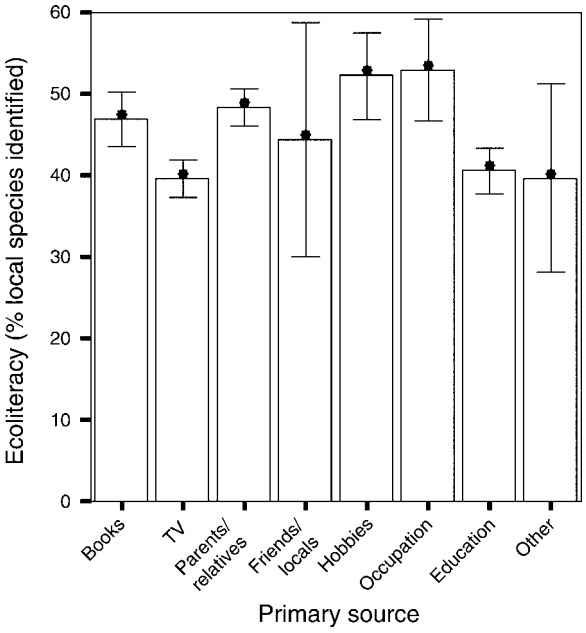


FIG. 3. Comparison of the ecoliteracy (mean ± 2 SE, $n$ = 646 respondents) of groups of UK respondents with different primary knowledge sources.

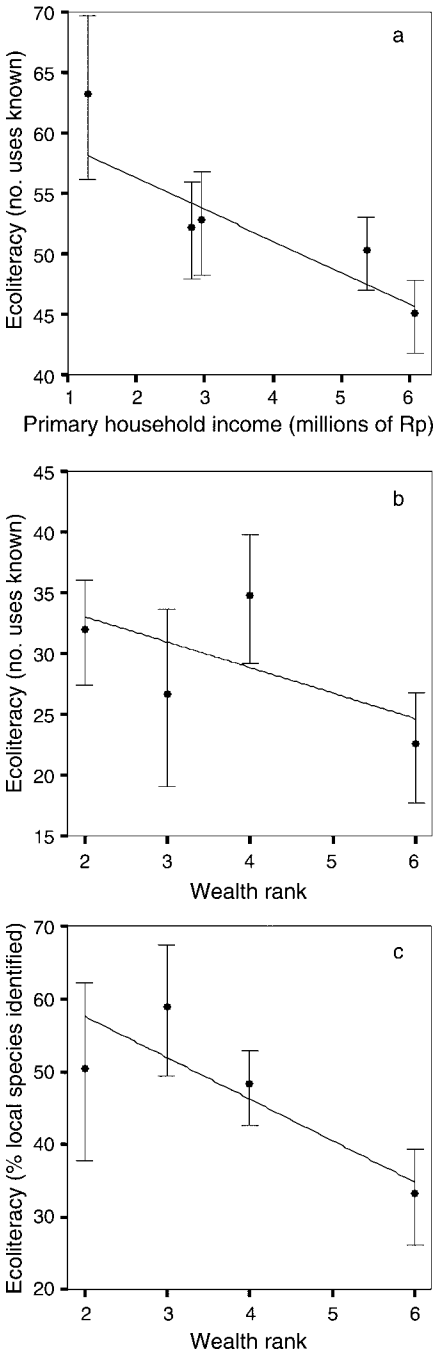


FIG. 4. (a) Number of local species uses known (mean ± 2 SE, $n = 164$ respondents) in relation to mean household income across five resource-dependent Indonesian villages in rupiahs (Rp). (b) Number of local species uses known (mean ± 2 SE, $n = 196$ respondents) in relation to wealth rank across five resource-dependent villages in India. (c) Ecoliteracy level (mean ± 2 SE, $n = 196$ respondents) in relation to wealth rank across five resource-dependent Indian villages. For panels (b) and (c), wealth rank ranges from 2 to 6, 6 being the wealthiest.

## DISCUSSION

In the United Kingdom, where societies are no longer resource dependent, ecoliteracy is increased by frequent countryside visits, living and growing up in a rural area, and acquiring knowledge of local plants and animals from informal word-of-mouth sources. These include parents, work colleagues, and hobbies. Those with low levels of ecoliteracy tend to have spent their lives in urban areas, rarely visit the countryside, and rely upon formal schooling and television as their primary knowledge sources.

Frequency of countryside visits and area of residence are key factors dictating the level of interaction an individual has with nature and, thus, their familiarity with the local environment (Orr 2002, Pyle 2002). The importance of childhood environment implies that a high level of interaction from a young age makes a difference to adult ecoliteracy levels (Nabhan and Trimble 1994, Kahn and Kellert 2002). In terms of knowledge acquisition, informal oral sources were found to be far more effective and reliable at transferring ecoliteracy than formal schooling and media sources. Despite this, more than 80% of children from industrialized regions rely on television and schooling to provide them with their ecological knowledge today (Nabhan and Trimble 1994).

At the India and Indonesia study sites, where local resource dependence is still high, ecoliteracy is affected by a different combination of social factors. Ecoliteracy was found to be higher in the least wealthy, most resource-reliant community members. Those with the lowest income are more likely to subsidize their daily food intake and income with local natural resources. For

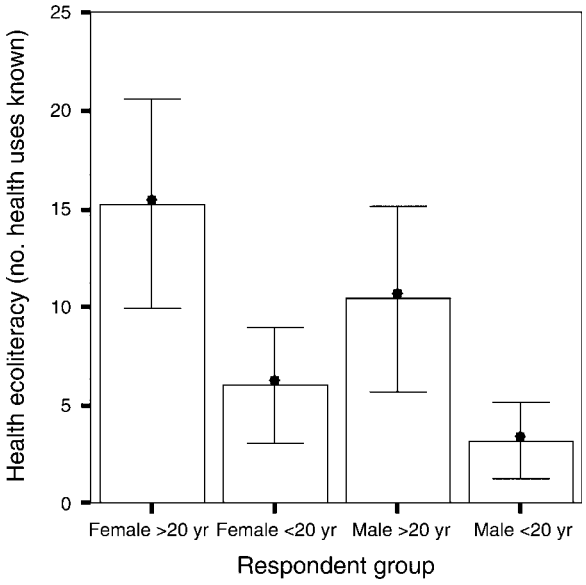


FIG. 5. Comparison of the number of local health uses known (mean ± 2 SE, $n = 196$ respondents) by men and women of different ages at the resource-dependent study site in India.

these groups, frequent resource collection and knowing which local species can be eaten, sold, used as medicines, and used in household construction is essential.

At the resource-dependent sites, schooling was often exclusive to children from wealthier families due to school fees and uniform and textbook costs (Folke 2004). The introduction of schooling into the lives of wealthy families has reduced the average time a child spends with their family members as textbooks replace traditional stories (Nabhan and Trimble 1994, Pyle 2001, King 2003), reducing the time available to learn local knowledge. King (2003) emphasized the importance of family- and community-based learning to the maintenance of ecoliteracy.

Both resource-dependent sites maintain traditional lifestyles, including gender-differentiated livelihood roles. This pattern is reflected by gender differences in ecoliteracy. At the Indonesian study site, it is the responsibility of men to go fishing and work on the land, and so they travel farther from home on a regular basis (Folke 2004). The role of women, however, is within and around the home. Any income-generating activities they participate in are situated close to the home, such as working in home gardens and gleaning the reef at low tide (Gopalakrishnan, 2003). Therefore, men's opportunities to experience the local environment and exchange knowledge with outsiders are heightened through traditional societal roles.

At the Indian study site, both men and women work in the local fields on a daily basis, which explains why no differences in total ecoliteracy levels were detected. However, men's societal roles dictate that they care for livestock. From a young age, most boys are in charge of feeding and caring for the family's herd of sheep or goats using just their own knowledge and skills. Women, however, are the primary caretakers in the home. This means that they are in charge of feeding the children and treating their ailments and any childhood diseases. Western medicines are either inaccessible or unaffordable to local families of this region (Tamil Nadu Human Development Report 2003). Consequently, women rely on their own knowledge of local medicinal plant species to treat common ailments and diseases. These gender-differentiated roles and responsibilities explain why men and women's ecoliteracy levels are similar, but have different areas of expertise (Pfeiffer 2002).

Wealth, therefore, is one predictor of the level of a person's interaction and reliance upon their local resources in addition to their opportunities for oral knowledge transfer from family members. Gender roles also predict the level of interaction a person has with the environment. In addition, gender roles affect the areas of knowledge that a person relies upon in their daily life and the people from which they acquire it from. For instance, when their child is unwell, young women are most likely to gain parenting advice from older women in the village.

This study shows that ecoliteracy is affected by a number of different factors that vary between non-resource-dependent and resource-dependent communities. This illustrates the importance of placing ecoliteracy within its political, sociocultural, and physical context both theoretically and practically. Such knowledge differentiation should act as a precautionary insight for future researchers to avoid solely focusing on expert knowledge and overlooking minority groups and their capacity to self-manage local resources.

At non-resource-dependent sites, the key factors affecting knowledge derive from lifestyle choices, including the time spent outdoors (active interaction) and the area lived in (passive interaction). At the resource-dependent sites, however, ecoliteracy is less a product of lifestyle choice and more a product of livelihood situation, such as wealth. We acknowledge that these factors may not cover the whole range of pressures affecting ecoliteracy levels. They do, however, provide some insight into what makes some people more knowledgeable than others in these different communities. Most crucially, however, this study reveals that the underlying factors impacting upon ecoliteracy remain the same at all sites, level of experience, and oral transfer, independent of culture, history, economic development, and acculturation to globalization. The importance of these two factors has previously been speculated upon by Nabhan and St. Antoine (1993).

The importance of direct experience to ecoliteracy level at all study sites provides evidence in support of Pyle's (2001, 2003) "extinction of experience." This occurs as an individual spends less time in the natural environment and, therefore, knows and recognizes less. Consequently, they act less to protect those species with which they are unfamiliar and more species extinctions occur. This leads to a downward spiral of disaffection and degradation resulting in environmental disconnection. Despite some 1.5 billion day visits being made to the countryside in the United Kingdom during 2004 (Countryside Agency, information *available online*),[6] the mean time that a child spends outdoors per day has declined from 86 minutes in 1981 to 42 minutes in 1997 (Orr 2002). If resource dependence and, thus, the necessity to interact with the environment on a daily basis declines in developing regions, a similar situation may gradually emerge.

Although other factors are instrumental in establishing sustainable management schemes, including land tenure, governance systems, and local institutions, the value of ecoliteracy in developing successful resource management strategies has been well documented worldwide (Agrawal and Gibson 1999, Posey 1999, Berkes et al. 2000, Ruddle 2000, Turner et al. 2000, Olsson and Folke 2001, Samson 2002, Rudd et al. 2003, Folke 2004, Olsson et al. 2004, Drew 2005). It is the one ingredient that cannot be introduced from outside and without it, support for local conservation activities in

[6] ⟨http://countryside.gov.uk/LAR/Landscape/RandE/dataHub/2004_dataarea/index.asp⟩

non-resource-dependent communities may wane and the capacity of traditional communities to self- or co-manage their own resources sustainably may be depleted (Feit 1988, Rudd et al. 2003, Lunquist and Granek 2005). The findings of this research suggest that international policy aimed at conserving ecoliteracy, with a view to maximizing the success of local resource management strategies, would need to introduce local institutions that focus upon the maximization of experience and oral transfer from a young age (Pretty and Smith 2004).

Local institutional policies would need to encourage site-specific activities that boost direct experience and word-of-mouth knowledge exchange. For instance, in the United Kingdom policies promoting family visits to the countryside twice a month and engaging in outdoor hobbies may be sufficient to have a significant affect upon ecoliteracy and reconnect people with their environments. Similar efforts to reconnect people with their countryside have been made by The Aldo Leopold Foundation's woodland school philosophy (information *available online*)[7] and Forestry Commission's Forest School Project (Forestry Commission 2006). In addition, this offers both mental and physical health benefits (Pretty 2004, Pretty et al. 2005).

In resource-dependent areas, local policies encouraging communities to maintain traditional practices and take pride in using locally available resources may have the potential to sustain ecoliteracy in the light of development; for instance, through controlled ecotourism programs that promote the traditional handicrafts and foods of local peoples. Local experience and word-of-mouth transfer, and, consequently, local knowledge bases, could also be enhanced through strategies such as land restoration in urban areas, greening places of work and school playgrounds, introducing home gardens, promoting the health benefits of re-engagement with nature, introducing traditional healthcare programs, providing incentives for local people to take part in environmental stewardship schemes, creating nature trails for children to walk along on their way to school, and increasing school field visits. If successful, ecoliteracy protection policies and enhancement strategies could become key tools in establishing support for participatory environmental management strategies for generations to come.

## Acknowledgments

We are very grateful to the following for help and support during field work: Z. Harris of Croydon library, Chrissie Hudson of West Wickham library, Bromley library staff, Old Wilsonian's Association and Gainsborough library staff; M. Hailes, C. Hailes, and P. Hailes of Kexby, Lincolnshire; the Society for People's Education and Economic Change (SPEECH), Madurai, Tamil Nadu, India, particularly J. Devavaram, A. Erskine, and A. Thangham; Operation Wallacea, Wakatobi, Indonesia, particularly Julian Clifton and Chris Majors. This research was supported by the United Kingdom's Natural Environment Research Council (NER/S/A/2002/10365).

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