Perceptions of Forest Health among Preservice Educators and Implication for Teaching Youth

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Perceptions of Forest Health among Preservice Educators and Implication for Teaching Youth

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The objectives of this study were to (a) determine preservice educators’ perceptions of forest health, (b) define the experiences which may have influenced their understanding, and (c) identify the approaches they might use to convey forest health information. Twelve interviews were conducted with preservice science and agriculture education students at the University of Florida who are likely to teach about forest ecosystems. Results suggest that many respondents understand ecosystem function, the importance of insects, and the effects of invasive species. Most respondents demonstrated little knowledge of diseases, fungi, and appropriate ways to use the analogy of human health. Several findings suggest these perceptions are related to the types of experiences respondents had with forests.

INTRODUCTION

One goal of school curriculum is to prepare youth to tackle complex issues (Jonassen, 2000). Although there is no shortage of current, challenging, complicated problems on which to practice, teachers may not have current information with locally relevant applications to create engaging interactive lessons to use in the classroom. Many complex environmental issues are burdened with popular misconceptions and confusion, making it even more difficult for teachers to know what to convey. Skilled, knowledgeable educators should be able to recognize prior knowledge that may interfere with learning (Bodner, 1986; Putnam & Borko, 2000).

Environmental educators can continue to assist educators address local ramifications of current issues by making these issues understandable, creating teaching materials or helping them find existing materials that follow current recommendations (NAAEE, 2000) and that allow students to reflect on existing knowledge while grasping new information (Lewis & Williams, 1994; Stapp et al., 1969). Teaming up with local experts can make this job easier, because they will likely have the background to understand the nuances in the literature and be able to focus on the underlying themes that will help make problem solving more likely.

The more an expert knows about the issue, however, the harder it may be to understand...
what the public knows, where they become confused, and what misconceptions students bring to the classroom. This is particularly true for topics that have not been a part of the curriculum—even though students have not been taught about a topic, they still have ideas about it that may interfere with a teacher’s attempts to provide information (Brody & Koch, 1990; Driver & Oldham, 1986; Kikas, 2004; Munson, 1994; Yip, 1998).

The topic of forest health fits this profile. Media reports tell of forest decline due to exploding populations of bark beetles (Kuiper, 2012; Maron, 2010)—hardly enough to base an exploration of forest health. The less controversial approach to teaching forest health, identifying insects, and evidence of disease, however, does not prepare youth to understand management questions and complexities or the many ways people alter systems for better and for worse.

When a local forest agency asked us to develop educational materials to help teachers convey a systems perspective to forest health, we took the opportunity to (a) better understand how educators understand this topic, (b) identify the information and strategies they may prefer to use when conveying information to youth, and (c) discover what kinds of experiences may have influenced their knowledge. In this article we report the simple procedure we used to understand this audience, what we discovered, and how curriculum developers could use these findings.

METHODS

The topic of forest health is not commonly covered in the life science curriculum, which means educators’ perceptions are likely to mirror the general public. The types of personal experience individuals have with forests may be an important factor that informs their understanding of forest health and whether they consider, for example, insects and fungi as tree-killing organisms or part of the ecosystem. To best understand the experiences and perspectives of respondents, we used in-depth interviews (Patton, 1987) with 12 preservice teachers at the University of Florida. Although the opinions of preservice teachers may not be identical to practicing teachers, the ease of identifying and working with university students to understand their thinking about a topic not included in the curriculum outweighed the need to use experienced educators. Discussions with professors who teach classes within two majors assured us that these individuals represent a variety of experiences with forests and were planning to become teachers.

Announcements to students in agriculture education teaching methods and life science education classes were made electronically and in person in January 2011 to invite students to participate. Fifteen students expressed interest in the study and received information following Institutional Review Board protocol #2019-U-1111. Twelve interviews were completed with five graduate students in life science, one graduate student in agriculture, and six undergraduate students in agriculture. Interviews averaged 20 min in length.

A semistructured interview guide was developed with four open-ended interview questions to guide the discussion to specific topics while maintaining flexibility to explore topics of interest (Ernst, Monroe, & Simmons, 2009; Patton, 1987). The guide was reviewed by three professors, simplified, pilot tested with preservice educators, and revised again to improve the prompts (see Appendix A).

The interviews were transcribed by the interviewer, coded independently by two people and analyzed according to grounded theory (Corbin & Strauss, 1990; Sandelowski, 2000; Strauss & Corbin, 1998). Each distinct thought was marked and given a descriptive code name. Codes from the interviewer and colleague were compared and where small variations occurred, both codes were incorporated into the analysis. Using the constant comparative method, codes were then analyzed again for similar ideas.
and regrouped into general themes (Burnard, 1991; Sandelowski, 2000; Strauss & Corbin, 1998). Quotes from the transcripts are used in this article to illustrate the major themes.

The study’s limitations constrain the findings. The relatively small sample of 12 pre-service educators limits the application of results to the population, but this is in keeping with a qualitative study and enables a richer understanding of respondents’ perceptions. Although the selection of life science and agriculture students may not effectively encompass all the educators who could teach about forest health, it does include the secondary teachers most likely to cover this topic. Finally, the recruitment method of opportunistically choosing volunteers limits our study to those most interested in forests or the highly motivated and academically engaged students. This does not necessarily affect the interpretation of the data, as the most interested and motivated teachers are more likely to voluntarily use supplementary resources on forest health if it is not specifically a part of the state curriculum or course textbook.

RESULTS

This section will describe the backgrounds and experiences of the participants, summarize their perceptions of forest health, describe the ways these respondents think about teaching students about forest health, and suggest ways that experiences have shaped those perceptions and ideas.

Participant Background and Experiences

The respondents came from an urban or suburban setting (n = 6) and a rural background (n = 6) with four of the rural respondents growing up in families who derived income from a farm, timber plantation, or plant nursery. Responses from these individuals often referenced their family business and information they “just knew.” Several participants worked in forest management and spoke of experiences that helped them understand forest ecology, plant identification, and changes in forests over time.

I learned a lot about the ways of the land from my dad. He never went to any schooling but he was a big naturalist…. Then going into the horticulture part with the business I learned more about the layers of a forest and the actual types of trees you’ll find in a forest . . .

(Respondent 8)

Participants described a wide variety of experiences in forests that coalesced in three categories—recreational, academic, and work-related. Most respondents (n = 10) spent time in forests recreationally (camping, hiking, hunting, and club excursions) with family or friends. Half of the participants had university-level academic experiences in forests which included observational assignments and laboratory experiments. More participants mentioned the influence of a university experience than a grade-school experience.

So last year I took general ecology which did a really good job of the lab for that. The class had an individual or group research project where you were supposed to be choosing your own ecological [community].

(Respondent 9)

Forest Health Perceptions

When asked to describe “forest health,” half of the respondents (n = 6) described an ecosystem-level perspective of forest health, incorporating trees, many other organisms, and sometimes abiotic components:

How well the ecosystem is doing—the soil, the trees, the plants, and animals that live in it. (Respondent 4)

Forest health. I guess when I hear that I take that to mean the health of the forest ecosystem in general. So that would include how both animal and plant species in that area are doing. (Respondent 9)
A majority of participants \((n = 8)\) expressed a belief that forest health differs from forest to forest. Although this belief illustrates a basic understanding of the dynamic nature of the term “forest health,” it also suggests the respondents are unable to generalize to a broad concept of forest health. When questioned, many of these respondents talked specifically about familiar forests and how they differ in health, based only on their experience:

> Because forests vary so much in the kinds of plants that live there, and the soil types and the hydrology and everything, I’d imagine [forest health] would be completely different in every forest. (Respondent 4)

Although their experience-based ideas are certainly true, these respondents were unable to describe forest health more generically in terms of a fully functional ecosystem with producers, consumers, decomposers, abiotic components, or management regimes. McKeough, Lupart, and Marini (1995) suggest that the ability to generalize a concept is a measure of the breadth of knowledge transfer; these participants’ comments indicate a limited amount of knowledge based on experiences in a few forests and little exposure to forest health.

Half of all responses \((n = 6)\) conveyed broad ideas that applied generally to ecosystem health, but not specifically to forest health.

> The introduction of certain species that don’t belong there. The loss of species that do belong there. Keeping track of those things. . . . Making sure that all the resources are there for the forest. (Respondent 6)

Several students \((n = 3)\) were not able to name more than one indicator or offered inappropriate indicators of health, such as wilted plants. Another three respondents, however, were able to describe several indicators, such as the abundance of dead or dying trees, insect infestation, a heavy woody fuel load, and the presence of invasive species.

Even with this range of understanding of forest health indicators, almost all participants \((n = 10)\) identified animals as an important component in healthy forests. Several explained that animal populations indicate forest health. Although this is an oversimplification and may not be accurate, the participants are revealing a fundamental understanding of the close relationship of animals to other elements in forests.

We specifically asked about the role of insects in forest health, because they are often the target of public concern to protect forest health. All respondents mentioned that insects play a positive role in forest ecosystems such as decomposition, nutrient cycling, and pollination though few mentioned a specific insect. Nearly all respondents \((n = 11)\) also mentioned the negative role insects play in forest health. Half of them spoke of invasive species and outbreaks of insect populations. Oddly, responses did not include feeding on trees. Based on what respondents chose to say, one might assume they have an incomplete understanding of the role of insects in a forest ecosystem. Although responses to our probes did not suggest it, an alternative explanation is that respondents felt that it is obvious that insects eat trees and not worth mentioning.

> I know some of them decompose and add nutrients back into the soil so in that sense, insects are very good but then you do have invasive insects that bore into the soil and kill off the trees. (Respondent 7)

Knowledge of disease in a forest and its spread was not commonly understood. Only a few of the participants \((n = 3)\) were able to articulate thoughtful responses about the role of diseases in forest ecosystems:

> In a recreational setting . . . a tree with a disease is just part of nature. . . . With disease, the diseases can help to provide habitat for wildlife. (Respondent 12)

The majority of respondents \((n = 8)\), however, were not able to offer much of an explanation of disease and may have thought very little about it: “if the forest doesn’t have a disease it would be healthy” (Respondent 5).

A few topics, such as invasive species, were not covered in the interview questions but were brought up by many respondents. This suggests
their familiarity with these topics. The majority of respondents \((n = 8)\) understood and indicated how invasive species can affect forest health. All of these respondents described the detrimental effects invasive species can have on native ecosystems.

**Teaching About Forest Health**

Participants were asked to think about important forest health topics that should be taught to students and how this information could be conveyed. They responded with a wide variety of ideas, such as the interconnected nature of elements within forests, human impacts, types of forests, management, safety, forest ecology, indicators of health, and the importance of forests.

The majority \((n = 7)\) of participants expressed the importance of teaching students about the interconnectedness of components within forests. Several of these participants were also the same respondents who demonstrated an ecosystem level perspective of forest health.

I would show them how a forest functions—the natural processes involved with forests growing and being systems. (Respondent 1)

Half of the respondents \((n = 6)\) felt it is important to teach students about human impacts on forests, both the ways we change forests and how we impact forest health. Helping students understand how they can improve forest health was mentioned by four respondents, who said this could build a sense of ownership and responsibility for forest ecosystems.

Well … you always want to make it relevant to the students. If they don’t think it’s relevant they’re not going to want to save it. The health of a forest is really important so I would definitely … say, “This is healthy. This is unhealthy. This is what we can do to preserve it. This is what we are doing to help. This is what you can do ….” (Respondent 10)

When asked about appropriate analogies to teach students about forest health, 11 of the 12 respondents independently mentioned human health as a useful analogy prior to prompting. This can be problematic because in most discussions of human health, we focus on individual people and disease is a something to avoid rather than a natural part of a healthy population and ecosystem. Although several responses may just be a result of careless articulation, these responses may also suggest flaws or problems with the way educators might understand the concept of forest health.

Certain insects are good for forest health …. We have millions of little bugs and stuff that are on our skin …. We need those certain insects on us just the same as a tree would. (Respondent 3)

Trees are just like people … They don’t live forever and at a certain point a tree has done all that it’s going to do. (Respondent 12)

**Relationships Among Background, Experience, and Knowledge**

Respondents who have not given much thought to forest health may not be able to articulate how they know what little they know. By tracking which respondents offered which perspectives, it is possible to suggest some potential relationships between background, experience, and how these respondents think about forest health. Those who grew up in working landscapes such as farms and timber plantations, for example, had experiences and knowledge that could not be obtained by those living in urban or suburban areas. The rural participants were the only respondents who had any ideas of the role of disease and death in a forest system. All of the students who discussed forest management were also from working landscapes and had a greater understanding of the ways in which humans manage forest ecosystems; their descriptions of forest health were deeper and more nuanced (see Tables 1 and 2).

Five of the six respondents who had forest-related university classes tended to explain their knowledge and understanding of
forest health in terms of general ecology and ecosystems. This relationship does not suggest causation, however. These students’ more holistic perspective of forest systems may have inspired them to take a forest ecology course, or the course may have enabled them to more effectively articulate their thinking. The responses in Tables 1 and 2 suggest that childhood and work experiences affect how people build a mental model of forest health. For some people, academic experiences might be memorable enough to affect that mental model as well.

DISCUSSION

Helping teachers convey important concepts about a complex issue requires that educational materials build from familiar or common knowledge, offer suggestions for recognizing and addressing misconceptions, enable students to grasp relevant and useful ideas that can be applied to a variety of contexts in the future, and help teachers learn, too (Davis & Krajcik, 2005). Indeed, although

Table 1
Forest health descriptions from respondents from working landscapes

<table>
<thead>
<tr>
<th>Respondent</th>
<th>Sources of knowledge</th>
<th>Indicators of forest health</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>We had the front 10 and the back 80 and it’s separated by a strip of land which we essentially were borrowing from the state because it was a conservation area right next to us. Probably, the biggest thing I learned in college is about the different types of forests and the different roles they play. It was a really difficult class. And I got a C in it but I feel like I learned the most from my plant ecology class.</td>
<td>Lack of pollution obviously, the introduction of certain species that don’t belong there. The loss of species that do belong there. Keeping track of those things and so forth and monitoring those things.</td>
</tr>
<tr>
<td>8</td>
<td>I grew up hunting a lot so I was out on my family’s land. So I grew up on that, walking it, knowing the land. I took environmental science so… Well, we went out to the natural area on campus so I guess we looked at the burning there and succession in the different plots.</td>
<td>To me, when you’re diagnosing a forest as healthy, you’re looking at different indicators of health, like number of tree species, the age of tree species, the amount of brush, the amount of species of animals living in the trees.</td>
</tr>
</tbody>
</table>

Table 2
Forest health descriptions from respondents from urban and suburban areas

<table>
<thead>
<tr>
<th>Respondent</th>
<th>Sources of knowledge</th>
<th>Indicators of forest health</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>The only stuff I really know is from that camp that we went to [Everglades Youth Conservation Camp].</td>
<td>Just maintaining healthy forests would mean making sure … using prescribed burns as management, stuff like that.</td>
</tr>
<tr>
<td>4</td>
<td>I didn’t experience forests much until the age of 30 because I was a city girl and lived in an urban setting my entire life. I really didn’t have any experiences with forests until I came back to get my master’s degree.</td>
<td>I guess if you wanted to look at indicators you study health over time. Maybe just looking at it once wouldn’t tell you much if you didn’t know the history of the forest but look at how the species are doing and see what changes happen over a few years.</td>
</tr>
<tr>
<td>5</td>
<td>Pretty much my only experience with forests is camping and then playing in them. I am from south Florida, … so I pretty much spent my life on the beach.</td>
<td>Simple stuff with plants is looking at if they’re growing and look healthy, if they’re all wilted and falling over, it’s probably not healthy. You can look for animals. If there are lots of animals it’s usually healthy.</td>
</tr>
</tbody>
</table>
good educators know this, our discussions with teachers who address forest health suggest that many begin and end their unit with insect identification. Although content experts will be able to distill the issue into key concepts and provide illustrative examples, they may not recognize the ideas that teachers and students are likely to bring to the classroom or the problematic analogies they might use. We found that talking to preservice educators and gathering their input helped provide insights that complemented the experts’ ideas for educational resources and provided important guidelines for developing useful curriculum.

**What They Know**

Half of these respondents were comfortable thinking about forest health as a healthy ecosystem. Most assumed animals are a part of a healthy forest, and they knew insects have helpful, important roles in pollination and decomposition as well as a potentially problematic role in forest health. Many were familiar with the problems associated with invasive species.

**What They Don’t Know**

Most respondents were not familiar with fungus or disease in forests. Some expressed misconceptions about the damage insects can do in forests and no one explained how management practices can compromise forest health. Many are not familiar enough with forest health to generalize from their experience to a more basic understanding of forest systems.

**How Educators Could Begin A Unit**

Beginning a unit on forest health with an ecosystem understanding is a reasonable approach. It would be useful to teach students to recognize the interactions that occur in a system, and how manipulations in one aspect of the system may result in changes to another. Because these respondents described their view of forests through a wide lens, with plants, animals, and abiotic elements, teachers should be comfortable beginning a unit this way. An ecosystem perspective also allows educators to emphasize interactions and relationships as they describe forest health. Although this is not a revolutionary insight, responses from some participants suggest they would emphasize field trips to experience a forest and the importance of stewardship; not ecosystem processes. That approach may fail to convey the context for understanding forest health.

**What Curriculum Should Include**

Although all of these respondents had some type of experience in forests, most were unable to describe multiple indicators of health and thought they would be unique to each forest. This suggests that experience alone will not convey forest health concepts—curriculum materials must enable educators to specifically teach about forest health concepts during students’ outdoor experiences and guide their reflection.

Because home and life experiences appeared to contribute to how these respondents understand forest health, one might assume that a class of students from different backgrounds will include a variety of perspectives. Instructional materials that enable teachers to assess student knowledge, select helpful activities, modify activities, and offer several versions of an activity to different types of students would be most useful. By the same token, teachers in urban and rural schools will need to be able to modify the same curriculum to address the prior knowledge that their students will likely bring.

Analogies can help bridge familiar to new information, but only if they are appropriate. Comparing human and forest health can be problematic in many ways. Knowing that teachers are likely to make this leap can help
curriculum developers be more explicit about the ways this analogy works and the problems that it may create.

This study revealed some interesting ideas that may be valuable for future research.

1. The respondents were keen to credit insects with beneficial roles in the forest, despite the public’s generally negative view of insects (Kellert, 1993). So generous were they with insects’ attributes that they mistakenly credited them with all the decomposition work done by microbes and fungi! Has the public come to accept and value insects differently over the last 20 years?

2. The popularity of animals in these responses may reflect a basic preference and familiarity of animals over plants (Wandersee, 1986) and strong media coverage about animals in nature. Does this mean the best way to learn about forest health is through animals? Is this preference for animals learned or innate; can we generate understanding for forest plants as well?

3. These respondents were familiar with the problems of invasive species, which may be a result of an emphasis on this topic from Florida agencies and environmental educators. Do preservice teachers in other states share this understanding?

CONCLUSION

The presentation of a new topic can often be troublesome for both teacher and student. Because a teacher’s knowledge of a topic influences students’ understanding (Khalid, 2001), educational resources should move both the educator and the student from their familiar and comfortable prior knowledge to a new understanding.

A relatively simple approach to learning more about what educators know and how they might approach teaching a complex topic was conducted to better understand how to develop materials on forest health. Qualitative interviews with 12 preservice teachers provided important insights that enabled us to develop educational materials that could be more readily accepted and understood by educators. Although practicing teachers might be a more ideal audience, preservice teachers are more easily accessed on a university campus. Only four broad questions and additional prompts enabled us to learn a great deal about their ideas and prior knowledge (see Appendix A). Themes and relationships may become apparent from reviewing notes or tapes, and these insights can be very useful to curriculum developers.

REFERENCES


Appendix A: Interview Guide

Thank you for helping with this research study. Do you have any questions before we begin? Please remember that you do not have to answer any question that you do not wish to answer. Would it be OK to tape record this interview?

1. Could you tell me about yourself?
   - Where did you grow up?
   - What courses have you particularly enjoyed? Which courses or subjects do you excel in?
   - Can you tell me about any experiences you have had with forests?

2. What does the term “forest health” mean to you?
   - There are lots of different types of forests—when you explained “forest health,” which type of forest are you thinking of?
   - What indicates a healthy or unhealthy forest? Are there indicators you could look for if you were to visit a forest that would tell you if it were healthy or unhealthy?
   - What is an insect’s role in a healthy or unhealthy forest? Dead trees? Diseases?
   - How could forest health be managed?

3. Imagine a forest today, and what it might look like 100 years from now if it were not converted to some other land use. Can you tell me about how these two images compare?1
   - Are the same microbes, insects, plants, and animals present?
   - Will the same individuals be present 100 years from now?
   - What changes might occur? What might cause these changes?
   - How might these changes affect forest health?

4. If you were teaching students about forest health, what do you think would be important for students to know and how would you convey this information?
   - Lots of people use analogies in teaching. Do you think there are appropriate analogies for forest health?
   - How are human health and tree health similar or different?

Thank you very much for your time and your thoughtful responses!

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1This question did not provide useful insights; respondents hadn’t thought about the future forest and had little to say.