CONNECTING NON-TIMBER FOREST PRODUCTS STAKEHOLDERS TO INFORMATION AND KNOWLEDGE: A CASE STUDY OF AN INTERNET WEB SITE

James Chamberlain, Matt Winn, and A.L. (Tom) Hammett[1]

Abstract—Many products are harvested from forests that are not timber-based but are based on plant materials. These non-timber forest products (NTFPs) have not been fully incorporated into economic development programs, yet they provide significant monetary benefits for rural entrepreneurs. Interest in NTFPs as alternative forest enterprises and sources of additional income has increased tremendously over the last decade. Unfortunately, information on their potential is not readily available when and where it is needed. With the use of the Internet, people have greater and easier access to information and those in remote rural areas may benefit tremendously from this access. People living in rural communities near forests are particularly attracted by the potential for growing and processing NTFPs for added income. The products in which they are interested range from herbal medicines, culinary items, crafts, as well as components to floral arrangements. The Forest Service U.S. Department of Agriculture Southern Research Station and Virginia Polytechnic Institute established one of the first Web sites dedicated to getting timely information to entrepreneurs interested in the market potential of NTFPs. The Web site provides a multitude of resources to help stakeholders learn more about NTFPs. This case study examines and analyzes various aspects of use to the Web site to better understand which product areas are of most interest to NTFP entrepreneurs, how much attention different knowledge formats get, as well as trends in accessing various media that indicates changes in topic interests. The presentation discusses challenges and opportunities of connecting stakeholders to information and knowledge about NTFPs that will affect their efforts to integrate these important products into livelihood and forest management strategies.

INTRODUCTION

Forests provide plant-based resources that are gathered from the canopy, the understory, the forest floor, and even below ground. Interest in these non-timber forest products (NTFPs) has increased to the point where they are being promoted as alternatives to timber. Astute landowners, willing to make the effort, may improve their forest-based incomes by gathering and marketing these products. Although, the markets for many NTFPs are well established and have formal channels through which the products flow, they remain unknown and mysterious to many forest landowners. Some segments of the NTFP industry have grown rapidly over the last decade, and some have great potential for continued growth. To realize the full benefits from harvesting NTFPs, forest landowners need high-quality and timely information such as marketing opportunities and production matters.

Chamberlain and others (1998) defined NTFPs as products originating from plants, parts of plants, fungi, and other biological material harvested from within and on the edges of natural, manipulated or disturbed forests. These may include fungi, moss, lichen, herbs, vines, shrubs, or trees. Plant parts harvested include the roots, tubers, leaves, bark, twigs and branches, fruit, sap and resin, as well as unique shaped wood.

Products made from these resources are classified into four major categories: culinary, wood-based crafts, floral and decorative, and medicinal and dietary supplements (Chamberlain and Predny 2005). Culinary forest products include sap, mushrooms, fruits, ferns, greens, as well as roots and tubers. Wood-based crafts are produced from trees or parts of trees, but exclude those made from wood which is cut from timber. Forest plants and parts of plants that are used in decorative arrangements complement and furnish the backdrop for flowers, as well as for the main component of dried ornaments. The end uses for many forest harvested floral greens include fresh/dried flowers, aromatic oils, greenery, basket filler, wreaths, and roping. Plants that have been tested for safety and efficacy and meet strict U.S. Food and Drug Administration (FDA) standards are marketed as medicines or drugs. Plants and plant products that do not meet the strictest FDA standards are marketed as dietary supplements in the United States.

In late 1997 colleagues in the Department of Wood Science and Forest Products of Virginia Tech and the Missouri Department of Conservation became acutely aware that there was a significant shortage of information on NTFPs and their markets. Working together, the collaborators developed and presented a prototype for a Web site (Hammett Jones and Araman 1997). Working through the Top of the Ozarks Resource Conservation and Development (RC and D), the collaborators secured support from the Forest Service, U.S. Department of Agriculture State and Private Forestry to prepare a series of fact sheets, which formed the foundation for the Web site. The Web site's original intent was to provide materials in user friendly formats for the general

[1]Research Scientist, Forestry Technician, U.S. Forest Service, Southern Research Station, Blacksburg, VA 24060; and Professor, Virginia Polytechnic Institute and State University, College of Natural Resources, Blacksburg, VA 24061.

public and to link buyers and sellers. The Web site was launched to serve as a clearinghouse of information for NTFP harvester, growers, marketers, processors and end-users.

SITUATION

To visitors, the Web site http://www.sfp.forprod.vt.edu "is your place to learn more about the use and markets for non-timber forest products" (Hammett and others 2001). These introductory words greet the visitor to this collaborative site and set the stage for what they will find behind the cover page. They rest under a banner of images depicting various NTFPs. Introduction to the Web site recognizes that there "are numerous efforts to increase awareness of these products, their management and market potential." But, the justification for this site is in the statement: ". . . there is a shortage of information available and there are few means effective in disseminating the information necessary for the sustainable management and marketing of these resources and products." To that end, visitors enter and explore a Web site dedicated to providing pertinent NTFP-related information and materials.

Figure 1 presents an overall layout of the Web site, with directories, sub-directories and possible paths visitors can follow through the site. Examination of the Web site's home page reveals a list of directories down the left side of the home page. These directories cover a variety of technical matters including: product areas, buyers, sellers, publications, fact sheets, tutorials, links, and workshops. Also along the left-hand border is a window that scrolls time sensitive items and noteworthy information past the visitor.

Clicking on one of the directories takes the visitor into that area of interest and subsequent directories. For example, entering the "product area" the visitor must choose from several product categories to explore. There are "hot-buttons" for medicinal and herbal products, decorative products, specialty wood products and edible products. The visitor also can choose from several searchable databases on specific species (i.e., bloodroot, goldenseal, and galax). Exploring deeper into this product area, visitors can enter the particular product area where they will find brief explanations of the product area (e.g., definition of edible products, common products, harvesting and marketing) and links to technical information.

Visitors interested in buying or selling products can click on the master "hot button" and go to these pages. There they are asked to enter pertinent data to make it possible for others to find their products. They can enter a brief description (up to 50 characters), which will be the initial display on the page.
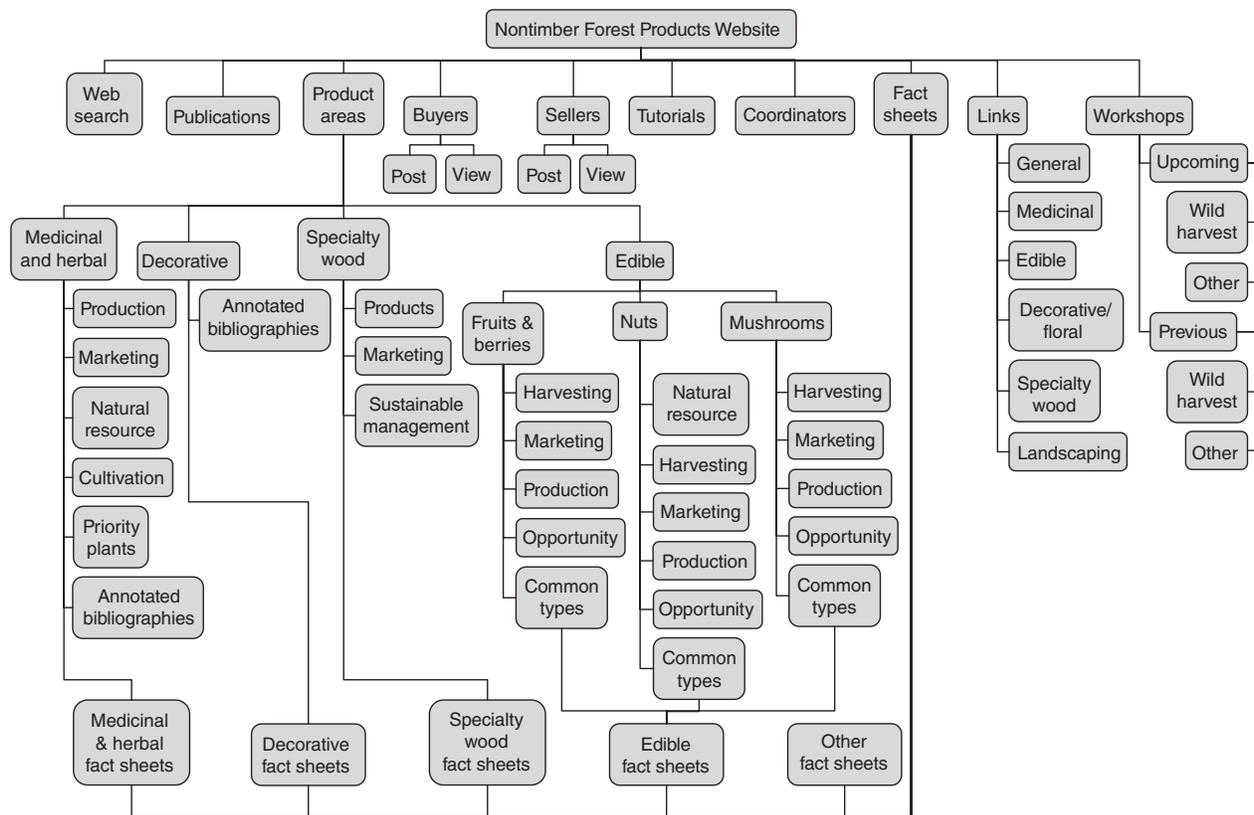
Figure 1— Web site structure with directories and sub-directories.

They are then encouraged to enter a more detailed (up to 250 characters) explanation of what they are buying or selling. The visitor can either search the database by product, or browse the entire list. The visitor who chooses to browse the list is taken to a page with "hot buttons" for each product.

Visitors can get technical information directly through the publications or fact sheet sections of the Web site. The publication section provides documents produced by the site coordinators as well as colleagues working with NTFPs. Documents are presented as portable document format (PDF) files that can be directly downloaded to a visitor's computer. Web site organizers have summarized pertinent information on species and products into easy-to-read useful documents, which are accessible through the fact sheet section. Within this section documents are organized by product category. Again, documents are presented as PDF files for direct downloading. Visitors are encouraged to communicate to the Web site coordinators ideas and suggestions for new fact sheets.

To help landowners and entrepreneurs assess NTFP production or marketing opportunities, the Web site coordinators installed tutorials to provide simple economic, production and conservation information about important NTFPs and related issues. Tutorials provide sources of information to assist in the development of NTFP enterprises. Two tutorials are available: "Writing Business Plans for Wild Harvest Sector" and "Growing Slippery Elm." Visitors are encouraged to comment on the tutorials and to suggest topics for other tutorials.

Visitors to the NTFP Web site have several other portals to explore. The Links section of the Web site provides visitors access to other useful Web sites. This section is organized by different groupings: Associations/Organizations working with NTFPs; Universities and Government Agencies; markets and vendors; reference materials, and; media and legislation. Another portal takes visitors to a listing of workshops, conferences, and trainings.

RESULTS

To provide a sense of the Web site and its role in technology transfer, we analyzed its usage with the software package "WebLog Expert" (WebLog Expert 2006). This software is a powerful log analyzer that provides information on Web site usage. This software presents statistics on Web site activity, accessed files, paths traveled through the site, information about referring pages, search engines, and more. The software generates reports on general activity usage: by day, by hour of day, by day of week, and by month. It provides access statistics (i.e., pages, files, images, directories, entry and exit pages), as well. The flexible and dynamic software also provides statistics on visitors: hosts, domains, and countries, States, and cities of origin. The software was selected because of its versatility and flexibility.

Although "number of hits" seems to be the most often quoted statistic as an indicator of usage, we find it is a deceptive statistic which does not adequately portray usage. The number of hits reflects the total number of requests for any file, image, or page (WebLog Expert 2006) and will fluctuate with the number of images found on a page. "Page View" provides a better representation of site usage as it is an actual request for a page file. The software used to analyze site usage determines the number of "visitors" by the Internet Protocol (IP) address. A request from the same IP address is received after a "timeout" period of 30 minutes is considered to be a new visitor.

Page views are a measure of the overall traffic to the Web site. Trends in page views can be used to show increases or decreases in total site usage over time. Web designers can use page views as a measure of interest in the Web site content. A steady decrease in interest may indicate that Web site content needs to be updated. Conversely, a positive trend indicates continuing interest in a piece of the Web site.

The number of visitors to a Web site can be used to determine the size of the client base. Low or decreasing visitor numbers can indicate that more outreach needs to be done to promote the Web site. It may also indicate that the Web site needs to be modified to attract a broader audience.

Combining the number of visitors with page views gives a measure of the length of stay for a visitor to the Web site. If the ratio of page views to number visitors is low, it indicates that visitors are leaving the Web site shortly after entering. This may alert the web designer to update the content or to change the navigational structure of the site.

Table 1 presents general usage statistics for the Web site covering the 5-year period from June 2001 through May 2006. The total page views increased every year, except in 2004, and suggest steady growth in usage. On the other hand, the marginal annual growth in page views indicates fluctuation in usage. From 2001 to 2002, total page views increased 139 percent. The percentage change for the next year (2002–03) was about 32 percent. The following year, usage decreased almost 20 percent. Proportional page views increased 87 percent from 2004 through 2005. And so far in 2006, the site has experienced 74 percent growth in page views.

The average page views per day also indicate steady growth, yet an examination of the marginal changes (i.e., incremental changes between years as a proportion) in page views per day suggest otherwise. From 2001 through 2002, page views per day increased almost 41 percent. The following period (2002–03), proportional page views per day declined to about 32 percent. From 2003 through 2004, proportional page views declined 20 percent. Proportional page views per day rebounded during the period of 2004

Table 1—General use statistics for NTFP Web site (June 2001—May 2006)

Description	2001	2002	2003	2004	2005	2006
Total hits	198,824	580,022	713,249	720,960	823,756	498,236
Average hits per day	929	1,589	1,954	1,969	2,256	3,299
Average hits per visitor	9.99	9.48	8.86	8.96	6.63	3.24
Total page views	31,568	75,599	99,877	80,207	150,274	261,968
Average page views per day	147	207	273	219	411	1,734
Average page views per visitor	1.59	1.24	1.24	1	1.21	1.7
Total visitors	19,906	61,187	80,478	80,433	124,283	153,827
Average visitors per day	93	167	220	219	340	1,018

through 2005, increasing 87 percent. From 2005 through May 2006, the site has experienced proportional growth in excess of 320 percent.

The average page views per visitor decline or remained steady for the first 3 years. From 2001 through 2002, the page views per visitor declined 22 percent. Page views per visitor were steady over the next annual period. From 2003 through 2004, page views per visitor declined 19 percent. This trend changed over the next period (2004–05), as the site realized a 21-percent increase in page views per visitor. The positive trend continued through May 2006, with a 40 percent increase in page views per visitor.

Except for the period 2003–04, the total number of visitors has increased each year. Between 2001 and 2002, the total number of visitors to the site increased 207 percent. The following period saw an increase of almost 32 percent. Total number of visitors declined during the period 2003–04 by about 0.06 percent. The site realized a 54 percent increase in total number of visitors during 2004–05, and almost 24 percent growth through May 2006.

Figure 2 presents the average Web site activity by hour of the day. While the horizontal axis tracks hourly usage, the vertical axis shows the percentage of total visitors during the time periods. By presenting the usage as a percentage of total visitors we are able to stabilize the figures to alleviate partial year differences. The site is least visited during the very early hours of the day. Visitation declines from midnight to about 0600 when visitation begins a steady and significant increase. Visitation climbs until about 1500 (3 p.m. eastern standard time), when it starts a slow and slight decrease until 1900. There is a slight increase in site visitation during the evening hours, until around 2200.

An examination of daily visitation provides insight into when people are visiting the site, as well. Approximately, 45 percent of visitation occurs Monday through Wednesday. Visitation starts to decline on Thursday and reaches the low point on Saturday. On Sunday, visitation begins increasing, yet not significantly more than Saturday. About 12 percent of total visitation occurs on Saturday, while Sunday realizes

just 13 percent of total visitors. These trends were consistent throughout all years.

Figure 3 presents monthly Web site activities over the 5-year period. The Web site attracted a steady stream of visitors over the last 5 years. The number of monthly visitors doubled during the first 4 years. An increase in visitation occurred during the period of August through November 2003, which coincided with our involvement in organizing the NTFPs side event to the World Forestry Congress. Visitation dropped after this event, but continued at a slow and steady growth. A drastic spike in monthly visitation occurred in September of 2005. From August to September 2005, the number of visitors per month increased 40 percent. Over the next month, visitation increased another 50 percent. From October 2005 through May 2006, monthly visitation to the site increased 123 percent.

The software used to analyze the site had the capability to track visitation to each page within the Web site. This information allowed for identification of those pages that visitors preferred. Next to the default page (i.e., the site home page), the most popular page, overall, was the page that introduced product areas. The pages that introduced visitors to publications and fact sheets ranked third and fourth, respectively. Within the product area, the page dealing with specialty wood products was the fifth most popular page, while the page presenting information on ramps (*Allium tricoccum*) was the sixth most popular page. The page introducing visitors to medicinal forest products ranked as the seventh most popular page. The edible forest products page ranked seventh in 2001, but dropped in visitation each year. In 2006, this page did not rank in the top 10 pages. The pages dedicated for buyers and sellers of NTFPs ranked in the top 10 every year. In fact, the buyers' page ranked third and fourth as most visited pages in 4 of the 5 years.

Another way of assessing the Web site is to examine the most downloaded files. This differs from the most popular pages, as these are files that people actually transfer from the Web site to their computers. Whereas the "most popular pages" are those that people visit, the "most downloaded
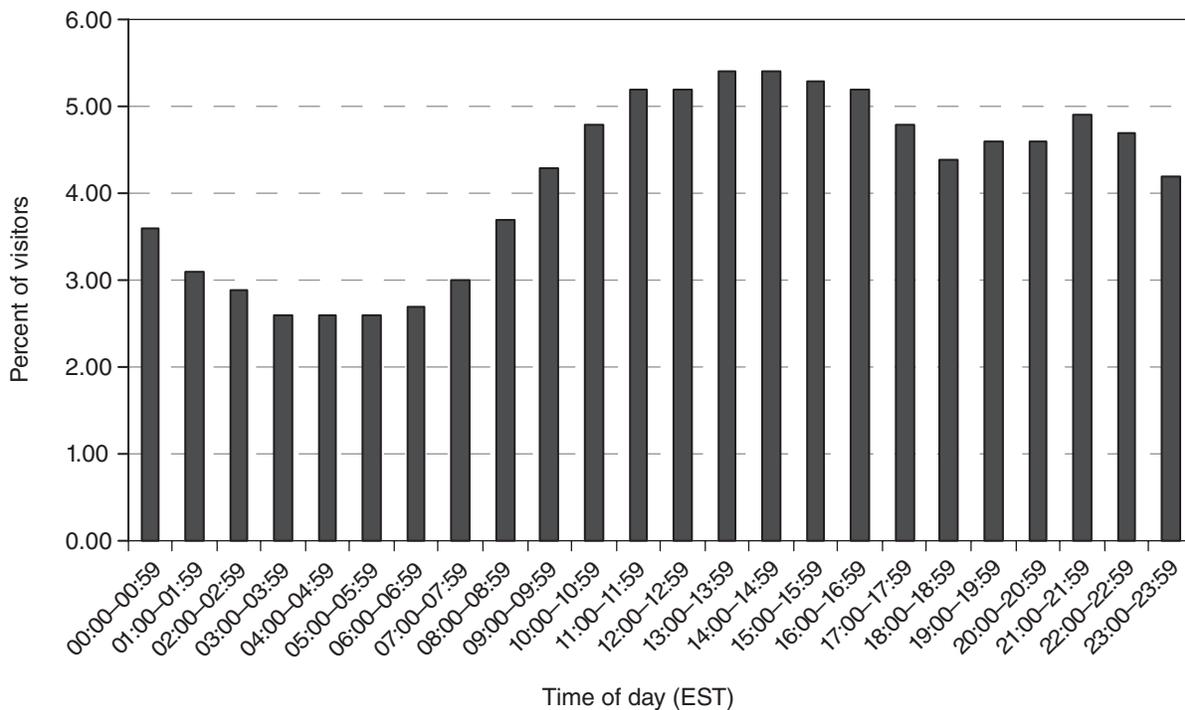
Figure 2— Average Web site activity by hour of day (June 2001—May 2006).

files" indicate what people take away from the site. Interestingly, the fact sheet on walnut (*Juglans nigra*) was the most popular downloaded file, overall. Ranked 12th in most downloaded files in 2001, the walnut fact sheet jumped to number 1 and remained the most downloaded file for the rest of the 5-year period. The fact sheet on sweetgum (*Liquidambar styraciflua*) ranked eighth in 2001, and climbed to third the following year. It ranked second or third every year since, and overall it was the second most downloaded file from the Web site. The fact sheet dealing with goldenseal (*Hydrastis canadensis*), a popular medicinal plant, ranked 25th in 2001, but for the 5 years it ranked 3rd overall. The fact sheet presenting information on vines and their use in making crafts was the fourth most downloaded

file, overall. It ranked sixth in 2001 and second most popular in 2002. In subsequent years, the vines fact sheet ranked fifth for most downloaded file. Other favorite downloaded files include fact sheets on persimmon (5th overall), Echinacea (6th overall), catnip (7th), pecan (8th), and beeswax (10th). Interestingly, a publication from a Canadian colleague on NTFPs was the ninth most downloaded file, overall.

The most requested directories indicate which areas of the Web site visitors are most interested. It provides an indication of those areas that people consider important. Awareness of this can help to provide focus on which aspect of the site should be enhanced. Obviously, the root directory (i.e., Web site home page) is the most requested directory as
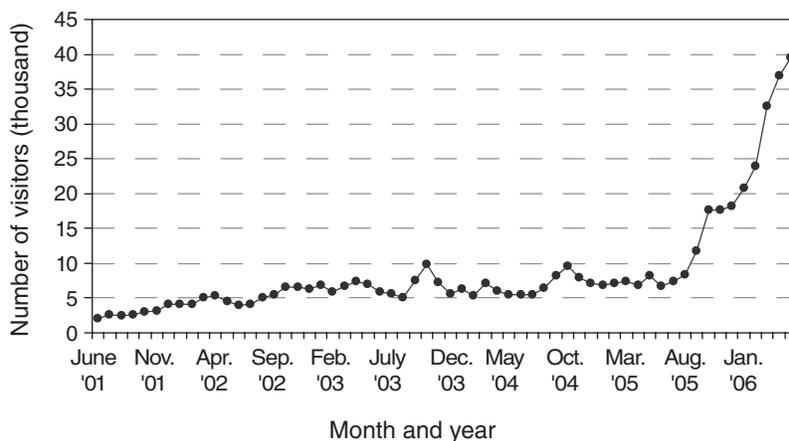

Figure 3— Web site activity by month (June 2001—May 2006).

this contains the main page by which people enter the site. It is similar to the cover of a book, which most people examine first. But, beyond that, the most requested directory allows us to better understand what areas visitors feel are important. Fact sheets ranked second, overall, to the home page as the most requested directory. The directory for "product area" was the third most requested directory every year except 2006. At the same time, the directory for publications ranked fourth, overall for the most requested directories. Other much requested directories include: Links (5th overall), Workshops (6th), Buyers (7th), Tutorials (8th), Regions (8th), and Sellers (10th).

The pages from which visitors entered and exited the Web site provide insight into the amount of exploring that people do of the site. For example, the product area dealing with ramps was the most frequently entered and exited page, next to the Web site's home page. The product area dealing with wood was the fourth most frequently entered page, and the fifth most frequently exited page. The publications page was the sixth most frequently entered page, but the fourth most exited page, suggesting that visitors explored the site further. Interestingly, the fact sheets page was the 17th most entered page and the 6th most frequently exited page, which suggests people entered the site from another page, found the fact sheets, explored them and then exited the Web site.

Visitors from all regions of the world have accessed the Web site during the last 5 years (fig. 4). As expected most visitors have come from North America (N.A.), accounting for 59 percent of the total visitation. For the first 3-1/2 years (2001–04), N.A. accounted for 82 percent of the total visitors. This proportion dropped in 2005 to 63 percent, with a major increase in visitation from Asia. So far, in 2006, N.A. accounts for only 20 percent of the total visitation. Africa and the Middle East account for approximately 1 percent of the total visitation. Over the 5-year period, Asia accounts for about 31 percent of the visitation, even though visitation from this region in 2006 is 74 percent of the total. For the years 2001 through 2004, visitation from Asia accounted for 6 percent of the total visitors. In 2005, visitation from this region increased to 28 percent, and topped 74 percent in 2006.

In all, people from 194 countries have visited the Web site. People from 60 African and Middle Eastern countries visited the Web site over the 5 years. Inquiries from Israel ranked number 1 from this region, yet visitation also came from South Africa, Turkey, as well as Iran. Visitors to the Web site came from 29 Asian countries, including China (number 1), India (number 2), Japan (number 3) and the Philippines (number 4). People from 47 European countries visited the Web site. Within this region, the Web site had the most visitors from the United Kingdom, followed by Germany, France, and the Netherlands. Visitors from 39 Latin American countries explored the Web site over the 5 years.

Brazil ranked number one, followed by Argentina, Chile, and Bolivia. Unquestionably, the Web site had more visitors from the United States than any other North American country, but Canada was well represented. Australia and New Zealand were the two leading countries from the Oceania region, although the Web site had visitors from 15 Oceanic countries.

DISCUSSION

The number of pages viewed by visitors appears to have grown at a steady rate, over the past 5 years, although looking at the marginal change from year to year, indicates significant annual fluctuations. The tremendous growth from 2001 through 2002 was followed by less growth the next year. There was an actual decrease in pages viewed from 2003 through 2004. Since then annual page views has increased significantly. Overall, the average number of page views per annum has increased through the 5 years.

Average Web site activity by hour of the day shows how visitation changes throughout the day. The trend indicates an increase in usage during business hours in the United States. After a brief decline, visitation increases during the evening, suggesting that people are "surfing" the web after work hours. As the Web site has a great deal of international visitation the increased evening activities could be visitors from other regions. For example, some of the evening activities may be explained by visitors from China, Philippines, and Japan who have approximately a 12-hour time difference from the server location.

The days of the week, as well as the hours of the day when visitations occur can indicate the best timing for the introduction of new materials. For example, introducing new information on Monday morning would attract more visitors than Friday afternoon. As more site traffic is taking place on Mondays through Wednesday, during office hours, launching new materials during these hours would receive greater immediate attention.

Monthly visitation rates increase steadily over the first 4 years. During the period of August through December 2003 monthly visitation increased and then dropped back to a steady growth state, which was caused by our involvement in the World Forestry Congress. During that period, we hosted an Internet-based discussion on critical issues that affect management of non-timber forest resources in preparation for the side event to the Congress, which we co-hosted. In August 2005 another spike occurred in the monthly visitation, which has been sustained over the last year. Although it is not possible to determine the exact reasons for this tremendous growth in monthly visitation, the increase could be due to more effort to publicize the site, and/or the recent introduction to the Web site of
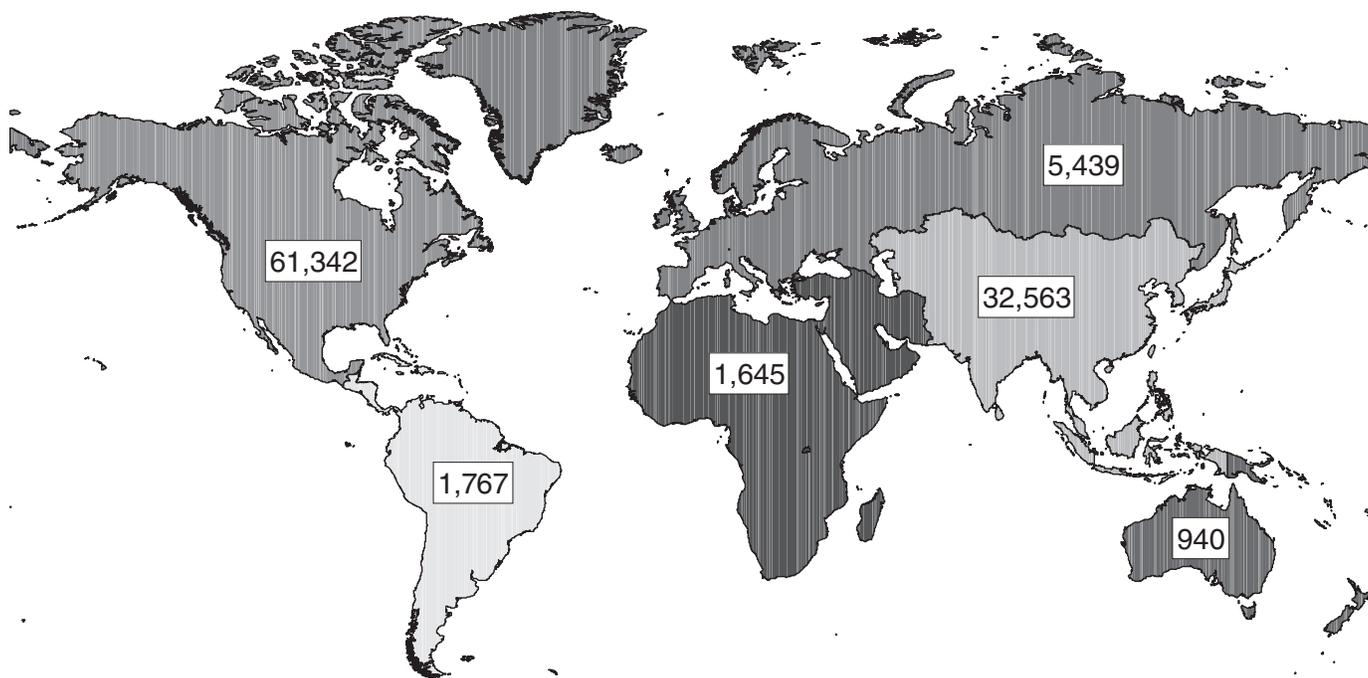
Figure 4— Web site usage by region of the World (June 2001—May 2006).

three searchable annotated bibliographic databases. Site coordinators routinely distribute promotional materials describing the Web site and its contents.

Examining which pages visitors go to can tell a great deal about what users want. By far, visitors to the Web site are looking for technical information about products. Their first choice is the fact sheets, followed by research publications. Visitors to the Web site have been most interested in non-timber wood products, as evidenced by requests for walnut and sweet gum. Product areas dealing with ramps and medicinal forest products also have received a great deal of attention. In general, interest in ramps and medicinal plants has increased over the last 5 years, which is reflected in the visitation to respective Web pages. People also have been interested in procuring or selling products. A continued effort to provide this type of information and materials would enhance the Web site.

The pages by which people enter and exit the Web site indicate if visitors travel through and explore the Web site. A visitor that enters and exits by the same page is less exposed to information and materials than a visitor who explores different pages. The fact that someone explores the Web site suggests that there is more information of interest. Conversely, if the entry and exit pages are the same, suggests that the visitor either found what they were looking for, or did not and exited without looking further. Web designers would want visitors to explore the Web site to find new and different information. Browsing may indicate that the site has piqued the interest of visitors beyond their original intent. Clearly, people interested in ramps found this

Web site of particular use, as they entered and exited by the same portal. Conversely, many users browed the Web site until they came upon the fact sheets.

People from all regions and more than 190 countries have visited the Web site. The proportion of international visitors continues to increase, suggesting that interest in NTFPs continues to grow around the world. Interest from Asia, appears to be growing the fastest. Continued efforts to provide information and materials relevant to international visitors are paramount to keeping the Web site attractive to this clientele. Active participation in international NTFP efforts by the coordinators is crucial to achieve this. There are many useful lessons for domestic stakeholders in the international materials presented.

Web site visitors have provided a steady stream of requests for information and suggestions, which indicate that they are interested in other matters not included on the site. Visitors, who can not find what they are looking for on the Web site, often send requests to site coordinators. Often questions posed relate to products or species not included on the site, or for cultivation or management information unavailable elsewhere. The Web site also generates a significant amount of telephone inquiries directly to the site coordinators.

Spam, the abuse of electronic mailing systems that sends unsolicited, bulk messages affects the Web site, as well (Wikipedia 2006). It has created serious problems, particularly in Web sites that have discussion forum or message posting. Spamming an Internet forum occurs

when a user posts a message that is off topic or has little relevance to the subject being discussed. The usual intent is to provide a direct link to the spammer's Web site. Many spam messages are posted using spam robots (or spam bots) that automatically search for vulnerable sites and submit information. On the NTFPs Web site, spamming has been problematic in the buyers and sellers forums. In the postings by buyers and sellers, some are nothing more than scrambled letters with embedded links to spammers' Web sites. Periodic inspection and maintenance of the forums is necessary to control unwanted posts.

CONCLUSIONS

Visitors to the NTFP Web site are looking for technical information that will help them realize opportunities to use NTFPs. Visitation increased over the 5 years, although this growth was not smooth, nor steady. The proportion of international visitors is increasing at a tremendous rate, demonstrating a need to keep adding information for a wider audience. Changes in visitation rates throughout the day and week indicate that the best time to introduce information and materials would be early in the work day and early in the week. There is clear evidence that major events in which the coordinators are involved effect visitation to the Web site. Clearly, more efforts are needed to keep adding new, fresh, and useful information and materials to the Web site.

This type of analysis is crucial to making a Web site relevant and interesting to users. It provides critical insight into when new materials should be introduced. New information introduced early in the week received more exposure than that which was put on the Web site later. The analysis confirmed that a major focus of the Web site should be on fact sheets and market information. Downloaded files indicate to the Webmaster which information users find most interesting and suggests that more emphasis should be placed on trees that produce wood and non-wood products. The analysis also exposed that there are many international visitors to this Web site and care should be taken to make the Web site interesting and relevant to that audience.

When the Web site was launched the set of stakeholders was fairly limited. With time, the community of stakeholders has grown as knowledge and awareness of different constituencies has increased. Getting the word out to new and different stakeholders takes constant attention by the coordinators and results in an increase in the number of visitors. At the same time, regular and diligent monitoring of all aspects of the Web site is essential to deal with the ever increasing problem of spam.

The data provides quantitative analysis of the Web site, although more user feedback would offer greater insight into what visitors want. The Web site could be further improved by including an online user survey that would allow for real-time assessment of the Web site. This would provide timely and useful suggestions on what users would like to have on the Web site.

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