The need for sustainable management of nature play areas: A survey of environmental impacts caused by children's play

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Introduction

The Emergence and Importance of Nature Play Areas

In the past 30 years, there has been a substantial reduction in the amount of time children spend in nature. In response, a "children and nature movement" which seeks to reconnect young people with the outdoors is growing rapidly, particularly in the United States. One increasingly popular technique is designating nature play areas (NPAs) in public forests.

Several benefits for children have been correlated with unstructured nature-based play activities. Studies suggest play improves self-esteem, motor function, and classroom behavior, and decreases anxiety, depression, and attention disorders. In addition, time spent in nature when young has been correlated with environmentally-aligned attitudes and behaviors when older.

Children's play is a developing recreation challenge

NPAs are often located in protected natural areas, and managers must therefore balance recreation activities with associated environmental impacts. The existing literature on recreational impacts provides little information on youth-related resource impacts or their management (Clark, et al., 1971; Vander Stoep and Gramann, 1987; Turner, 2001; Hockett, et al., 2010). Despite this lack of knowledge, new plans are being made for increasing play opportunities on public lands.

As more NPAs are developed and opened, land managers will need to know how unstructured play activities of children affect natural conditions and what techniques are available to avoid or minimize such impacts. Best management strategies for NPAs are currently being developed by trial and error. This preliminary study provides the first dataset on what impacts are caused by children during play, where these impacts occur, and what might be done about them. It is complemented by an ongoing study in well-established Sweden NPAs.

Methods

Recreation ecology and play observation

Three NPAs in eastern U.S. hardwood forests were surveyed. Each had been operated for two to four years, sized over 0.5 hectares, and visited by 3,500–10,000 children annually. Survey methods were adapted from previous recreation ecology studies (Wood, Lawson and Marion, 2006). Additionally, unobtrusive observation methods were developed. At each NPA, trails and recreation sites were measured, trees and shrubs were surveyed, and play was observed. First, each trail was categorized as formal (FT) or informal (IT), based on whether it was manager-created or child-created. Length was measured, and ground cover characteristics, width, and cross-sectional area were recorded using a point sampling method. Control conditions at adjacent, ecologically-similar undisturbed sites were recorded. Second, recreation sites were identified as formal (FS) or informal (IS). Size was measured using the variable radial transect method, and impacts to ground vegetation and soil were recorded. Data from controls conditions were also collected. Third, each tree and shrub over 2.5cm DBH was counted in recreation sites. Size classes were assigned. Extent of damage and root exposure was documented. Fourth, 11 hours of play was observed and resource impacts were noted. At regular intervals, the actions and locations of random populations of children were recorded. Documented impacts included trampling or picking flora, damaging shrubs and trees, digging or moving soil, moving logs, moving rocks, or disturbing fauna.

Data analysis

Trail and recreation site data were compared with controls. Vegetation loss and soil exposure was estimated by multiplying size with percentage difference of ground cover at site minus control. Total soil loss was estimated by multiplying trail length by mean cross-sectional area.

A binary logistic regression model was created to determine significance ($\alpha \leq 0.05$) of child-related factors and their relationship to environmental impacts. Data from observations were used. Factors were treated as independent variables, and included gender, estimated age, and group size. Impacts were considered dependent binary variables.

Results

Use of nature play area features and resulting impacts

Children played most commonly in recreation sites. IS were used 46% of the time while FS, 29%. FT and IT were used 9% and 3%, respectively. On average, NPAs had two FS (avg. 732m^2), two IS (avg. 89m^2), one FT (avg. 78m x 206cm) and three IT (avg. 66m x 69cm). One NPA layout is shown in Figure 1.

Impacts included vegetation trampling, soil exposure and loss, and damage to trees and shrubs. Average decreases in vegetative cover were 61% or 231m^2 (FS), 64% or 63m^2 (IS), 55% or 140m^2 (FT) and 47% or 5.8m^2 (IT). Mean soil exposure increased 28% (FS), 5% (IS), and 34% (IT) but decreased 7% on FT. On average, 0.21m^3/km (FT) and 8.5m^3/km of soil were lost due to compaction, subsidence,

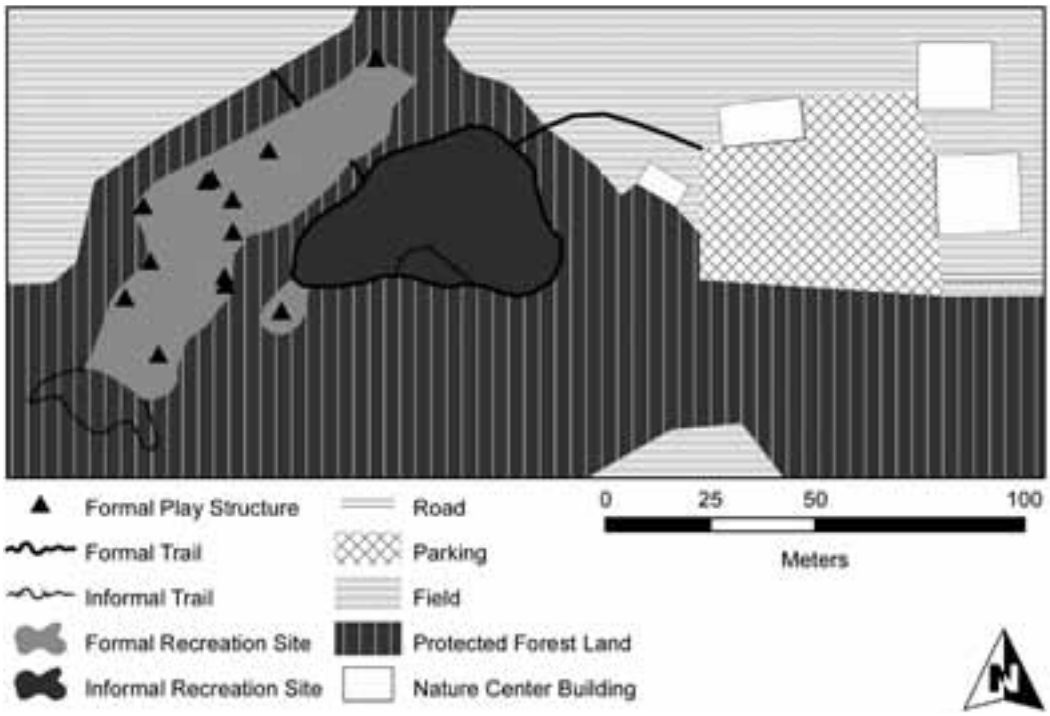

Figure 1. Map of NPA

or erosion. At FS, 48% of trees and shrubs were injured on average, while at IS, 42% were injured.

Frequency of impact

Based on observation data, children's play in NPAs caused impact 33% of the time. These impacts were primarily related to habitat disruption and included digging soil (15%) and moving logs (6%). Impacts to flora or wildlife occurred less than 5% of the time.

The binary logistic regression model uncovered several significant ties between child factors and impact. Smaller group sizes were significantly more likely to cause any type of damage, move logs, and trample flora, while larger groups were more likely to move soil and rocks. Males were significantly more likely to cause any type of damage, move logs, and trample flora, while females were more likely to move soil. Older children were significantly more likely to move logs.

Discussion

This study suggests children's play has measurable impacts on the environment. Play may cause long-term ecological changes, especially in highly visited urban NPAs. From an aesthetic perspective, loss of vegetative cover is the most visually obvious form of impact. Ecologically, the exposure and slow loss of soil is a more lasting and significant impact, along with tree and shrub damage.

Although impacts from children's play are a concern, natural area management often requires balancing preservation and recreation mandates. NPAs and related activities are a salient objective of many agencies and organizations, and their benefits are increasingly being promoted and studied. Additionally, unstructured experiences in nature may help build a new generation of conservationists who will be more supportive of setting aside and protecting natural areas. Ultimately, managers must accept some degree of resource degradation if they choose to promote the societal benefits of connecting children with nature through outdoor play. Preventing avoidable impacts and minimizing unavoidable impacts at NPAs by proper site selection, site reinforcement, and adaptive management is recommended (Leung and Marion, 1999).

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