The Impact of External Variables on Management Practices in Protected Areas: An Analysis

FINAL REPORT

Prepared for Conservation International

May, 2011

UCLA Senior Practicum in Environmental Science (2011)
UCLA Institute of the Environment and Sustainability

Prepared By:

Naomi Elliott | Anni Gill | Amanda Grossi | Daniel Hogan | Ben Kertman | David Molmen | Shannon Skelton | Charlotte Stanley

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i. Abstract

Our research focuses on the important question, how do cultural, economic and environmental factors influence conservation efforts? The threats to our ecosystems has lead to large amounts of biodiversity loss, exemplifying the importance of effective management plans to restore biological systems. Conservation International (CI) provided our group with data sets regarding management attributes and protected area site descriptions. Our research team compiled a list of 12 quantitative external factors that might describe relationships with the scores of our management attributes. Our data team used statistical analysis (two-tailed t-test) to compare the trends of the scores for each management attribute with quantitative external factor trends. Our goal was to provide CI with the management attributes and types of protected areas they should prioritize in order to make the most informed investment. Conservation sites that lay within areas that propagate the most influential external factors (Number of Endemic Species, GNI, and Percentage Urbanized) should be of upmost focus. Furthermore, the management attributes related to plans, land and boundary issues, and biodiversity targets, should receive increased attention as they are highly related to the external factors. There are also trends that suggest that funds may not be currently distributed in a manner consistent with CI's stated strategies.

I. Introduction

Biodiversity conservation is a pressing global issue. With increasing deforestation and rapidly growing urbanization levels, greater efforts to conserve the earth's precious forest resources are crucial. Protected areas help ensure that specific portions of rainforests and their native biodiversity are set aside for preservation for future generations. Unfortunately, protected areas face complications internally, from improper management and insufficient funds, and externally, from economic and cultural country pressures.

Despite the urgency of necessary conservation actions, obstacles with protected area management have brought about inconsistent progress. While the implementation of policies for established protected areas is intended to advance biodiversity preservation, conservation organizations have not established a set of systematic operational principles based upon previous conservation efforts (Dudley 2006). The design and presence of management attributes for distinct protected areas must be studied to see how protected area management has been approached in the past. After reviewing the patterns of different management strategies and assessing the relationship between internal and external factors influencing protected areas, it would then be possible to establish a coherent management mechanism that ensures the most efficient use of limited funds while bringing about maximum conservation.

A thorough method of prioritizing conservation management attributes is necessary for protected area success. Conservation International (CI) does not yet have a consistent method of distributing funding across protected areas or among management attributes. We conducted extensive research on successful management techniques, reviewed existing CI management implementation and developed statistical models to analyze the correlations between various management attributes and external variables that may influence conservation efforts. Identifying external influences on management attributes and the corresponding external qualities of each site leads to unique management attributes per protected area, making the most out of conservation efforts. Through execution of this project, we are providing CI with recommendations as to which management attributes to prioritize per country in order for them to make the most informed investment of the Global Conservation Fund (GCF) and thus maximize conservation of biodiversity.

II. Significance of the Project

With almost seven billion people inhabiting the earth, pressures upon the ecosystem due to over-exploitation and human development have lead to biodiversity loss. The threats to our ecosystem leading to large amounts of biodiversity loss exemplify the importance of effective management plans to restore biological systems. Although large strides have been made in preserving global biodiversity, resources remain scarce. We hope to provide CI with a methodical management plan promising greater immediate returns on their investments.

There is currently a lack of a cohesive management plans between conservation organizations that analyze the specific actions and investments required to achieve management objectives. The repercussions of this discrepancy are only exacerbated by the continually rising costs of effective monitoring and enforcement while the available funding levels off (Walker 2009). Since funding is limited, it is vital that Conservation International maximize conservation of biodiversity through efficiently allocating resources to successful management practices. A global review of protected areas (PAs) conducted by the International Union for the Conservation of Nature (IUCN) revealed that management and policy inadequacies account for three of the five most commonly reported threats to biodiversity (Van der Duim & Caalders 2002, Hockings 2003). Through appropriate prioritization of management techniques CI has the power to alleviate biodiversity loss. Effectively allocating funding can also provide the momentum for improved conservation efforts.

Our team examined the management attributes across sites and time as well as the sensitivity to external factors. We evaluated the effectiveness of previous management strategies to create recommendations that are intended to help PA managers identify and correct weaknesses in the hopes that management objectives can be met with greater efficiency. The results provide a much needed status update, general outline of significant management attributes and external factors, and a foundation for future analysis. The recommendations help determine the level of funding different management attributes should receive, creating a model for future investments.

III. Research Question

Are management attributes among protected area types susceptible to cultural, economic and environmental factors, influencing conservation efforts to effectively maintain the state of biotic (biodiversity) resources?

If so, which management actions should be prioritized to achieve the expected results of interventions required to conserve/manage the area?

External variables that we have identified as the sources of the pressures that pose a threat to maintaining the biodiversity are:

Cultural: population/urbanization, growth, education levels

Environmental: natural disasters/climatic events, topography, biodiversity

Economic: development level, site size, exports, tourism, forest/local economies

IV. Literature Review

Analysis of the Effects of Management Attributes and External Influences upon Conservation

Introduction

Effective management strategies are essential for the protection of forests. The livelihood of ecologists, biologists, and natives depends on the well-being of this environment. Although protected areas (PAs) have been designed to restrain deforestation, deficiencies in their management design have allowed the habitat to continue to degrade. Furthermore, it has become increasingly clear that PA success depends not only upon the management style but also upon the ability to measure the efficacy of management practices. Creating precise and accurate measures to test for management effectiveness and implementing better management strategies will increase the success of PA and the likelihood of adoption of future PAs. In this review, we describe the multiple ways to measure management and PA efficacy and fully investigate the key management attributes proposed by Leverington et al. Our goal is to discuss each management attribute's significance in a practical context to extrapolate the ones that are most important to success in order to provide stakeholders with information on where placing their funding will give them the biggest return on reducing deforestation. Moreover, external factors inclusive of broadscale socioeconomic variables shall be examined with an emphasis upon their relation to PAs and deforestation.

This review seeks to examine the ways in which the success of PAs has been evaluated as well as the results of such evaluations, with a specific focus on the effectiveness of various attributes and factors. Therefore, the literature inspected and synthesized in the following text includes literature that has had a specific comparative focus on analyzing the effectiveness of different protected zones based on indicators and attributes. Conservation biology is an immense and diverse field of study. In such a broad field, it has been decided to generally leave out literature that is area-specific or methodology-specific. Since the review seeks to understand the importance of particular factors on management success across conservation zones, the research needs a form of comparative analysis to be included in the review. For broad-scale overviews of management attribute effectiveness, a large focus will be put on the Leverington et al. 2008 literature due to its unique synthesis of over 8000 area assessments composed of varying and

diverse parameters and measurements. Subsequent research will zoom in to examine literature dealing with the attributes and criterion themselves to gain further insight into the importance of individual attributes. Lastly, a series of external variables will be investigated for their impacts upon conservation and deforestation.

Background

Conservation International (CI), established in 1987, helps fund the global conservation of biodiversity and protects against deforestation within PAs. There is a decrease in deforestation due to the mere existence of PAs (Leverington et al. 2010), ranging from small indigenous lands to large national parks. CI created a division that "finances the creation, expansion and long-term management of priority areas for conservation" called the Global Conservation Fund (GCF) (CI 2010). GCF uses the following three strategies to achieve their objectives: only make investments to high priority areas based on scientific knowledge, always support the long term management of such PAs, and allocate additional funds for further protection (CI 2010). The goal of the fund is to provide resources to areas with exceptionally high biodiversity. These funds are very limited, and PAs seeking such funding are required to participate in CI's management evaluations. These evaluations help CI determine which sites are "effectively" conserving the biodiversity within a site.

Terminology

The following terms are commonly used within conservation biology and conservation management literature.

Protected Area (PA):

In 1994, the World Commission on Protected Areas of the International Union for Conservation of Nature (WCPA-IUCN), as part of an attempt to universalize conservation efforts, defined protected area and assigned six new sub-categories to the umbrella term. The definition of protected area is as follows: An area of land and/or sea especially dedicated to the protection and maintenance of biological diversity, and of natural and associated cultural resources, and managed through legal or other effective means (Naughton-Treves et al. 2005). Conservation

International defines a PA as "any area managed for the purpose of conservation under some type of legally binding agreement or legislative recognition" (CI 2010).

Biodiversity:

Biodiversity is the degree of variability of life forms within a given ecosystem, biome, or an entire planet, where greater biodiversity implies greater health. Biodiversity connotes the richness and variety of life on Earth (Selvik 2004).

Deforestation Success:

In the strictest manner, deforestation success occurs when the rate of deforestation decreases and/or when deforestation stops as the result of management of the PA. Deforestation failure occurs when management attempts do not have an effect on the rate of deforestation.

Management Attribute:

The World Database on Protected Areas (WDPA) defines an attribute as: Essential pieces of information about the spatial data (i.e., boundaries) that aid in the analysis, reporting and tracking of trends in the growth and coverage of the world's PAs.

Overview of the Existing Management Assessment Strategies

Measuring Forest PA Effectiveness

There are many ways to measure how much service a PA has provided for the forest ecosystem, inclusive of methods of analyses entitled Broadscale Outcomes, Coverage, Detailed Monitoring, and Protected Area Management Effectiveness Assessments (PAME). The first method is called Broadscale Outcomes, which is an analysis of the impact of large-scale impacts on the forest such as logging (Leverington et al. 2010). The second method is Coverage, which aims to describe how much biodiversity is covered within a PA. This method is limited to only forest coverage and does not take account the status of biodiversity within the forest. Thus, the method leads to problems such as the "half empty forest" syndrome where the forest appears unharmed while many of the animals that once populated it have disappeared for various reasons including wildlife trade. The third method for determining PA effectiveness, Detailed Monitoring, takes the analysis further by addressing biodiversity health. This method primarily

focuses on animal populations, forest ecosystem condition, and cultural and socioeconomic impacts (Leverington et al. 2010). The fourth and most comprehensive method, Protected Area Management Effectiveness Assessments (PAME), includes the above aforementioned three methods. PAME is the result of the efforts of the WCPA to create a "Management Effectiveness Evaluation Framework" (Stoll-Kleemann 2010). These assessments are based on six criteria for effective management: Context, Planning, Inputs, Processes, Outputs and Outcomes. Each criterion is composed of management indicators that serve to cover the scope of each criterion's general aim. A description of these indicators organized by criterion can be found in Table X.1.

Measuring Management Effectiveness

Management effectiveness evaluation (MEE) is defined as "the assessment of how well the PA is being managed – primarily the extent to which it is protecting values and achieving goals and objectives" (Stoll-Kleemann 2010). The three most popular methods of MEEs are Rapid Assessment and Prioritization of Protected Area Management (RAPPAM), Management Effectiveness Tracking Tool (METT) and Enhance our Heritage (EoH).

There are several factors that differ amongst these MEEs: number of indicators, ranking range, number of assessors included in the evaluation process, age, region, etc. Alone, these evaluations are not sufficient to address management effectiveness; however, together these systems cover the wide expanse of information necessary for its analysis. The main challenge that arises is how to consolidate this information from so many different evaluation systems.

Conclusions of the MEE Synthesis based upon the PAME Framework

Leverington et al. used the PAME Framework to identify which management indicators are most related to overall effectiveness, have the most successful outcomes and require the most attention. These are as follows:

Highest association to overall effectiveness: adequacy of infrastructure, equipment and facilities, natural and cultural resource management processes, effectiveness of governance

Most successful outcomes: skills of staff and management partners, constraint or support by external civil or political bodies, achievements of outputs and adequacy of law enforcement

Requiring critical attention: appropriate programs of community benefits and assistance, management effectiveness evaluations, natural resource and cultural protection measures, involvement of communities and/or stakeholders (Stoll-Kleemann 2010)

Conservation Strategies

The current rate of global extinction for plants and animals, due to anthropogenic sources, is more than a thousand times higher than the typical rates throughout life's history on earth (Pimm et al. 1995). However, conservationists do not have the time or resources to conserve species one by one (Ehrlich 1992). Focusing on limited areas of higher potential biodiversity promises greater immediate return on investment than spreading resources evenly or focusing on areas of little diversity but greater interest in biodiversity. They need to maximize the return from conservation investments. Large-scale conservation planning initiatives, such as biodiversity hotspots have been among the effective responses to this need in guiding global conservation investment, but there is a large need to create strategically targeted conservation programs for organizations and efficiently allocate funds to yield the largest amount of return for their investments (Myers et al. 2000).

Strategically targeted site conservation programs can tackle the main cause of extinctions by reducing the loss of natural habitats and of the species that they shelter (Bruner et all. 2001). It is therefore critical to identify those sites where globally important biodiversity must be conserved in the short term. If biodiversity is to be protected, there is an urgent need to establish a similar methodology for the identification of site-based targets using quantitative criteria that can be applied consistently.

Key Biodiversity Areas

Site conservation is among the most effective means to reduce global biodiversity loss. Therefore, it is critical to identify those sites where unique biodiversity must be conserved immediately. Thus, the concept of key biodiversity areas (KBAs) has been developed. The creation of KBAs is intended to ensure that networks of globally important sites are safeguarded. KBAs have a set of four criteria based on vulnerability or irreplaceability (Margules and Pressey 2000). However there are limitations in managing these KBAs, and it is necessary to build a general framework and criteria for administering the sites. Such criteria should be easily applied

and involve stakeholders to maximize the usefulness of the resulting site priorities (Younge and Fowkes 2003). KBAs were developed with the rationale that they would be globally important sites that are large enough or "sufficiently interconnected to support viable populations of the species for which they are important" (Bibby 1998). The KBA approach is unique in the sense that it does not aim to minimize the size of the site network. Rather, it provides the universe of sites significant for conservation (Margules and Pressey 2000).

Alliance for Zero Extinction (AZE)

By applying explicit criteria for initial site selection, KBAs are different from procedures such as Alliance for Zero Extinction (AZE) because they provide a more effective starting point for complimentarily based procedures, whereas AZE procedures utilize applications such as grid-based distribution maps, which are stated to not correspond with relevant management units on the ground. The AZE prioritizes highly threatened sites, and KBAs prioritize based on the most urgent conservation action.

AZE sites are identified as critical for the survival of one or more globally identified endangered and critically endangered species. Moreover, the AZE procedure is intended to prevent the most imminent species extinctions. There is no management prescribed for AZE sites. The limited amount of management of such sites varies according to the type of PA they are part of prioritizing based on urgency to act to prevent impending global extinctions, however it is for this reason these sites have been identified as irreplaceable targets for a global network of PAs.

Although PAs have been designed to restrain deforestation, deficiencies in their management design have allowed the habitat to continue to degrade. While KBA conservation should aim for all sites to be managed to safeguard the important biodiversity that they shelter, the types of conservation tactics that are appropriate may vary with socioeconomic context. Thus, KBAs should form part of a wider, integrated approach that embraces conservation not only of sites but also of species and landscapes (Redford et al. 2003).

Protected Area Establishment and Size

Establishment

Despite deficiencies in management, the existence of PAs as a conservation strategy is generally considered good groundwork for conservation efforts (Leverington et al. 2010; Rodrigues et al. 2004). Indeed, the mere existence of PAs is correlated with reduced deforestation rates, even when funding and broader institutional support is grossly inadequate (Leverington et al. 2010). Moreover, additional studies have demonstrated that the rates of deforestation and clear-cutting are significantly lower within PAs compared to their non-protected counterparts, as well as across temporal scales comparing the site before and after the protection measures were initiated (Leverington et al. 2010).

Site Size

The size of the land area is proportional to the cost of the PA (Fahse et al. 1998). In determining the size, an area must be large enough to contain all nearby species, yet small enough to maintain with the given funds. CI's PAs range from 60 to 41,050,000 hectares.

Large land areas can conserve more biodiversity and prevent more deforestation than small areas. Moreover, large PAs have a lower chance of losing species, unlike small areas which act as biogeographical islands; loss of species correlates to PA size (Parks & Harcourt 2002). In the United States and Africa, size is additionally correlated to human density near each PA, leading to smaller areas becoming more isolated, with stronger edge effects (Parks & Harcourt 2002). Conservationists want to preserve a larger area, but high costs and human land use limit the size of an area.

Small PAs may not be able to preserve entire populations of species, depending on the species' range. Species with larger ranges need larger PAs (Rodrigues et al. 2004). "Covered species" live entirely within a PA; "gap species" have part of their habitat outside a PA (Rodrigues et al. 2004). Areas need to contain all parts of a range, such as a breeding area, (Fahse et al. 1998) for full conservation of a specific species, and this is more likely in a larger area. If an area is too small and does not conserve the entire range of all target species, the area size is not optimal for funding (Fahse et al. 1998).

Protected Area Legal Characteristics

Legal gazetting of sites and presence of binding contracts for conservation

PAs are legally the property of the country within which they exist. To ensure a PA will be conserved, official commitments of these source countries are necessary (Findley 1997). A helpful mechanism for achieving conservation is the establishment of contracts between governments, local groups, management groups, and stakeholders.

Contracts work by creating economic incentives for source countries to conserve biodiversity (Rubin & Fish 1994; UNCED 1992). Equal benefits must be provided to all parties, mainly through royalties, profits, fees, or technology to source countries (Rubin & Fish 1994; Mays & Mazan 1996). In order to establish a contract, incentives must be enough to make all parties' best interest be conservation (Hunter 1997-1998).

Contracts are most effective if provisions are site specific, guidelines are thorough and obligatory, economic benefits are given to source countries, and monitoring and enforcement are required. With an effective contract and appropriate funding, source countries and land owners must follow the conservation guidelines, contrary to if no contract existed, a goal of conservation could be abandoned at any time. Source countries may not efficiently conserve biodiversity without legal obligations, and developing countries cannot force locals to conserve; contracts act as fair business deals covering the necessary requirements for each specific land area.

Many agreements have been put into practice in the world, varying in implementation success (Ankerson 1994). Various factors lead to ineffective conservation agreements. An effective contract needs detailed obligations and methods of enforcement for it to be followed (Ankerson 1994; Hunter 1997-1998). Periodic monitoring and reporting of the PA will ensure the source countries with follow through with conservation (Ankerson 1994). The largest issue with effectiveness of agreements is inadequate funding or technology to implement conservation (Ankerson 1994; Pressey 1996).

An effective international contractual agreement must be unique to its PA. Contract provisions exist to conserve the biological resources of the land, maintain site management, and protect the locals' lifestyles and communities (Rubin & Fish 1994; UNCED 1992). Contracts ensure national and international laws are followed, and may even create new standards if no national laws exist (Mays & Mazan 1996). Specific provisions may protect endangered species, limit use of materials for genetic or chemical purposes, provide employee training, build and

maintain research and educational facilities, or provide financial support (Rubin & Fish 1994; UNCED 1992).

Length of Binding Contract

Contracts must be set at a certain length, and when it expires, land owners can choose to extend the initial contract, update the contract, or continue with no contract. Contracts are designed to gain maximum environmental benefits with the given budget and time (Chen & Ando 2006). A contract creates a fixed agreement, and opportunity cost can be created, which is why indefinitely long contracts are ineffective (Chen & Ando 2006). Contracts are difficult to adjust in the middle of their duration; they must be fully prepared at the start of the contract, and should not be so long that they may never be altered.

Optimal contract length differs for different areas, depending on the current stage of the land. Species in some areas can take up to 40 years to be fully restored (Chen & Ando 2006). The particular features of an ecosystem, the time period for environmental benefits to develop, and regional characteristics determine different optimal contract lengths. Some regions have a longer conservation turnover rate and some ecological services grow more quickly than others. Optimal contract length must be less than the time for the benefits to level off. The optimal contract length for a particular area can be determined by a combination of ecological and non-ecological characteristics (Chen & Ando 2006).

Limited information is available on optimal contract lengths. Future research should go more in depth on how contract length affects PA effectiveness, for each particular land type.

Boundary Demarcation

The conservation literature demonstrates that boundaries are an integral component of conservation efforts. In particular, conservation strategy generally emphasizes focusing upon demarcating boundaries that respect ecological integrity (Chape et al. 2005, Ervin "Protected" 2003, Grumbine 1994, Grumbine 1997, Olson & Dinerstein 2002).

But while boundary demarcation of PAs is important, the literature also reveals that management of the land surrounding the PAs is likewise imperative (Hansen & Defries 2007; Defries et al. 2007). Land use change surrounding PAs diminishes and often counteracts

management efforts within the PA borders (Hansen & Defries 2007). Prime contenders for land use include those people pushing for development, conversion of the land for agriculture, and tourism advancement (Ervin "Rapid" 2003). Many management schemes erroneously view the PA as separate from the larger surrounding ecosystem (Hansen & Defries 2007). However, when the surrounding environment becomes degraded, the PA becomes a functional island, and as island biogeography theory explicates, such a situation is deleterious to biodiversity due to increased edge effects, fragmentation, and other ecological effects (Hansen & Defries 2007, Wells & Brandon 1993).

Funding

Financial support is the fundamental cornerstone of the effectiveness of a conservation zone (Strategy 2009). An estimated $277/km2 is required for effective management, yet the average funding in developing country PAs is around $100/km2 (Walker 2009). Investment is not only needed for the establishment of areas, but also needs to be consistent to successfully sustain the indicators that have shown to be of clear importance, contained in the elements of inputs, processes, outputs, and outcomes (Stolton et al. 2007). As a recent study illustrated, the cost to monitor and enforce areas effectively is continually increasing, yet the available funding has leveled off (Walker 2009).

A key determinant of the success of PAs is allocation of funding and infrastructural resources, where longer term commitments on both of these frontiers are associated with more successful sites and higher levels of sustainable practices (Leverington et al. 2010). Nonetheless, though adequate funding is highly correlated with the success or failure of a PAs, a majority of PAs, namely sixty percent, lack adequate funding to meet basic management necessities, such as properly trained individuals, relevant equipment, and other infrastructure requirements (Leverington et al. 2010). Moreover, a 1994 global review of PAs conducted by the IUCN revealed that inadequate funds were reported as a threat in nine of the fourteen regions (Hockings 2003).

Furthermore, even when adequate funds are present, there is a pressing need for specificity when allocating the money (Ervin "Rapid" 2003; Leverington et al. 2010). Conservation goals are better met when the planning process is clear with money directed toward

enforcing specific laws (Leverington et al. 2010). For example, Business and financial plans are used to organize the distribution of expected funding (Stem et al. 2005).

Management Plans

Management planning as an attribute is poorly addressed in scholarly literature (Dudley et al. 2007). In the limited research examining the management process itself, management planning as an attribute has scored poorly in studies that correlate attribute implementation with PA effectiveness (Leverington et al. 2010). Management plans internationally have been beset with problems such as little "attention to budgets; unrealistic assumptions of management capacity; poorly formulated objectives; excessive detail deferred for further study; failure to allocate responsibilities for implementing plans (making subsequent monitoring impossible); undue emphasis placed on specific aspects of management; institutional instability; and absence of systematic procedures for producing management plans" (Clarke 1999). Many articles cite methods for improving management planning; however, there are none that show any empirical success (Clarke 1999; Aung 2007).

Business and Financial Plans

Business and financial plans are created as organizational tools for decision-making and are a way of addressing the issues unique to that zone or region (Stem et al. 2005). Conservation plans use and require a multitude of data that includes ecological distributions and dynamics, the potential impacts of threatening processes, as well as the socioeconomic and geopolitical circumstances that affect the conservation area planned. Conservation planning may also weigh estimated costs and benefits of various actions (Grantham et al. 2008).

Business and financial planning allows long-term oversight through direction, objectives, and budgets. However, the strategies of how conservation planning is approached are just as critical to conservation success as the existence of the plans themselves. One meta-study created four outcome measures to determine the success of conservation projects to account for the diversity of plans. The four criteria established were ecological, economic, attitudinal, and behavioral (Brooks et al. 2006a). The results showed that social-science strategies such as "utilization, decentralization, and market access" were successful planning strategies in conservation (Brooks et al. 2006a).

One challenge to using the existence of financial and business plans as indicators of success emerge from the sense that it is not simply the presence of plans, but whether they address the multitude of concerns unique to each PA. This can only come from trust in the management, well-trained staff, and an engaged community (Brooks et al. 2006b).

There have also been found to be diminishing returns in conservation planning, which emphasizes the importance of distributing the available funding to areas that can give the strongest response to the area (Gratham et al. 2008). One study points out the importance of funding to keep plans in place, but suggests that further investment is better used elsewhere once the plans have been established. Finding the tipping point at which investment and return is maximized is a major challenge for conservation planning.

Monitoring and Evaluation Systems

The ability to monitor and evaluate a PA scored in the top 5 indicators of success in Leverington's analysis. Monitoring, evaluation, research, and law enforcement were found to have poor scores from the PAME analysis, but are highly correlated with effective conservation. This suggests that in order to properly conserve PAs, focus is required on specific activities to manage and monitor the attributes and progress of an area (Leverington et al. 2008).

Research suggests that a well-established monitoring and evaluation system is a crucial link to successful planning. (Brooks et al. 2006a). In conservation zones, community based monitoring was more effective than top-down management (Brooks at al. 2006). Top-down management, in which the community has little control over the management area, results in outcomes in which monitoring becomes sporadic and "illegal resource use" becomes common (Walker 2009). The outcomes model cited higher behavioral, ecological, and economic success rates in studies where well-established community-level institutions had greater control (Brooks et al. 2006b). But successful community based monitoring is only possible with adequate funding (Brandon et al. 2005).

Managers require research and data to determine where to apply management techniques, and afterward, to evaluate and evolve their techniques to be more effective (Ervin 2003). Without adequate monitoring and evaluation systems, this evolution of management technique is not possible, and managers make evaluation decisions based on qualitative or experience-based

metrics. In an evaluation of over 1000 Australian-run parks, researchers found roughly 60% of "conservation decisions" are supported only by anecdotal or the manager's observational evidence, and not on qualitative data (Cook 2009). In the same study, over 25% of the assessments showed that managers felt they had inadequate monitoring information to evaluate their decisions.

Some problems with monitoring and evaluation data are that there is a very loose wording for what is "comprehensive" monitoring. Additionally, monitoring is largely hindered by funding. One study used a Game Theory model to try and predict the success of protective areas (Walker 2009). The three key variables used in the game theory model were "costs of monitoring for rule breakers, benefits of catching a rule breaker, and probability of catching a rule breaker if monitoring" (Walker 2009). When the monitoring costs exceeded "the product of the probability of catching a rule breaker and the benefit of doing so," successful conservation was found to be unlikely (Walker 2009). The study found a serious void between the cost of monitoring and the amount of funding and investment available.

Security is interconnected with funding, monitoring, and community relation. Even with adequate monitoring, an inability to enforce illegal activity or resource use renders that monitoring useless (Walker 2009). This requires proper funding and community involvement (Western & Wright 1994). The simultaneous convergence of conclusions from independent and varied studies suggest that the particular input factors of funding, monitoring, community, and security are of utmost importance for effective management plans and protection.

Community Involvement

Interaction with local communities is essential to the success of PAs (Heinen 2010). Establishing a bidirectional communication line from PAs to locals helps decrease instances of poaching, illegal logging, and other deleterious exploitations within the forest.

Locals Involved with Management and Ecotourism

Many investigations of community involvement, namely through community based management and ecotourism, have been carried out to evaluate the effectiveness of the process and to analyze the outcome of deforestation prevention. Community-based management has

proved an effective management tool whereby initiating and maintaining communication with locals, calling upon their services to achieve conservation goals, and providing them economic incentives to invest time and energy into the project (Altrichter 2008). Locals must feel that they are not being abused or undermined, but rather involved and respected in order to develop their active support and a positive outlook for the establishment of the neighboring PA. When the local communities surrounding PAs are called upon to be advocates of the environment, the necessity for funding by outside management is reduced and the economic benefits, along with the various social and environmental incentives, can be locally realized and utilized. There are over "2.2 billion people living in the 45 countries that supported 89% of tropical forests in 2000", and if their incentives are met and they possess the knowledge and skills necessary to carry out their duties, these locals can be and should be considered valuable resources in the management of protected resources (Colchester 1994). Nonetheless, for conservation efforts to succeed at the local level, communities cannot feel restrained by the establishment of the neighboring PA but rather develop and grow as a society in a manner that is sustainable and reflects social justice (Colchester 1994).

This success in utilization of locals is demonstrated by the ecotourism industry in the Grande Riviere. Here, the forestry department plays an active role in regulating human activities; however, much of the success of leatherback turtle preservation is attributed to the locals who filled a majority of the jobs surrounding local tourism and the efforts to save the endangered leatherback turtle (Waylen 2009). Once locals were informed of the dangerous condition of the species, consumption of turtle meat became rare in the region, and local guides made sure that the beaches remained safe from visitors during hatching season (Waylen 2009). In this community, conservation has become a way of life for the participants and it is likely that their successful projects will carry on through the generations.

Locals as Highly Regarded Stakeholders

Not only do local communities provide a valuable source of labor, they also make economic contributions to promote conservation success in established PAs. CI's involvement in various projects has led to the investment of 104 million dollars in leveraged grants by outside stockholders (Conservation International 2010b). These stockholders include conservation organizations of various sizes, private donators, as well as local communities investing in the PA

for returned economic and environmental benefit. This large sum of money has promoted success in deforestation, but it is crucial that relations with stockholders be maintained for these grants to continue activity.

At the December 2009 United Nations Convention on Climate Change, a new management plan to mitigate global climate was discussed through reducing emissions from deforestation and forest degradation (REDD) (Sasaki 2010). This plan requires that the "the roles and responsibilities of all stakeholders" are clearly outlined in order to conduct effective management in a manner that respects and accounts for the cultural and social uses of forests according to unique preferences of indigenous tribes (Sasaki 2010). This management plan was implemented in Cambodia when a forest-dependent community engaged in deciding which types of trees should be planted for harvesting, since it directly impacts their cultural livelihood. Additionally, the local community was given a portion of the "carbon-based revenues" as payment for their efforts and added incentives to continue responsible management (Sasaki 2010). As stakeholders are given more of the carbon-based revenues with increased involvement in REDD-plus projects, greater incentive for locals to support carbon trading and a decrease in logging and carbon emissions has ensued. (Sasaki 2010). Local communities have insight and expertise that outsiders lack, and sharing this information in a collaborative environment will give back to all of the stakeholders, including the locals. Typically, when locals are trusted with management duties, there are additional incentives to carry out their responsibilities. This, coupled with environmental results of their efforts and feedback on ways to improve, provides ample motivation for the local communities to stay involved, keep up monetary investments in the site and preserve their neighboring land.

Adequate Staff Presence and Training Skills

An integral component of securing sustainable staffing and training involves acknowledgment of the role of the local people as a valuable indigenous staff (Ervin "Rapid" 2003; Grumbine 1994; Leverington et al. 2010; Wells & Brandon 1993). For instance, local people can be indispensible in aiding conservationists by providing and gathering information, acting as consultants for critical project issues, deciding upon adequate project designs, implementing strategies, and providing unique perspectives in evaluating project efficacy (Grumbine 1994; Wells & Brandon 1993). Moreover, local participation in data collection has

ancillary benefits of increasing the credibility of the conservation projects among local communities, as well as catalyzing the diffusion of the research amongst the local people (Chase et al. 2000). Increasing the credibility is critical for garnering funding and participation and thus conservation success (ibid.). Nonetheless, local people are not often incorporated into management strategies for multifarious reasons, such as the generally short-term planning of projects with concomitant myopic designs, existent authority frameworks in the locale of the project, and a knowledge deficiency surrounding socioeconomic structures during project planning (Wells & Brandon 1993). Additionally, authority frameworks, government resistance to individual empowerment as well as inadequate infrastructural capacity to permit widespread participation in the decision-making process inhibits the local people from being tapped as a resource (Wells & Brandon 1993).

Ecotourism is an increasingly attractive option facilitating the inclusion of local people into conservation efforts as active participants. Ecotourism provides the economic incentives for local people to efficaciously conserve biodiversity due to the inclusion of the communities in the benefits of the process (Campbell 1999; Ervin "Rapid" 2003; Stronza & Gordillo 2008; Van der Duim & Caalders 2002). Moreover, ecotourism provides the concomitant benefits of an inflow of money, personnel assistance, and technical expertise, which serve to further bolster conservation efforts (Stronza & Gordillo 2008). Evidence of the weighty and intertwined roles of money and community involvement in conservation is provided in Central America, where it has been demonstrated that a heavy influx of international remittances to El Salvador is correlated with a decrease in deforestation through a reduction of pressure to capitalize upon and plunder natural resources to provide a source of income (Hecht & Saatchi 2007; Wells & Brandon 1993).

Furthermore, with respect to adequate training, education plays a fundamental role in shaping conservation outcomes. In particular, meshing regional conservation education initiatives, which are broad and often lack the specificity to be pragmatically adopted by locals, with local conservation initiatives, which may be too narrow to address the larger picture issues surrounding regional conservation needs, promotes cooperation across multiple levels of management and increases the chances of project success (Fernàndez –Juricic 2000).

Law Enforcement

At the same time, increasing the number guards to protect PAs can also inhibit harmful use of the forest. Two expansive studies conducted by Dudley et al. (2007) and Leverington et al. (2010) found that management attributes highly correlated with protection of biodiversity and positive community impact are adequacy of law enforcement and community outreach. These two attributes are logical, given the most pressing threat posed to a majority of parks is "consumptive biotic resource use" (e.g. poaching, logging, non-timber forest products) in part by local populations (Dudley et al. 2007). In a 330-site, multi-nation study, Dudley et al. found that this was the most pressing problem in over 60% of the PAs observed. Increasing the magnitude of these two attributes will fight this pressing threat on two fronts. On one side, increasing law enforcement presence helps stave off illegal hunters and loggers. On the other, programs that foster an appreciation for the park or utilize the park as a sustainable source of income may turn local populations away from exploiting the park via poaching and logging.

Both Leverington et al. and Dudley et al. cited the presence of law enforcement and a high density of guards as the most significant contributors to PA success (community outreach programs correlated almost as significantly). A large amount of site practitioners recognize interaction with local communities and installation of education and awareness programs as "critical management activities" that require immediate attention, which they believe will significantly reduce threats and increase PA effectiveness (Dudley et al. 2007). Equal and substantial weight needs to be placed on both law enforcement activities and community outreach in order to maintain PA integrity (Dudley et al. 2007).

Education & Awareness Programs

The most efficient method for bolstering law enforcement within parks while simultaneously aiding the local community can be achieved through incorporating the local populations into park operations. Involving local populations in the parks tends to decrease consumptive biotic resource use by the locals through instilling a sense of ownership, and acceptance within the park (Fabricius & Koch 2004; White et al. 2005). Acceptance by the local community is essential if PAs expect to preserve biodiversity and remain sustainable (Heinen 2010). Furthermore park employment provides a source of income to those who would otherwise turn to poaching or illegal hunting. When community participation is encouraged, managers find that PA effectiveness in preserving biodiversity increases, as do the community's acceptance of

the park. In a poll of park managers (Stoll-Kleeman et al. 2010), 60% of total respondents reported "improved social acceptance" of their parks, while 45% of total respondents reported improved conservation success, after implementing community participation activities.

In a case study of four reserves around the world, a lack of staff proved to be the most pressing problem (Gibson & Marks 1995). This was directly due to a lack of funding in three of the four sites. As seen in studies by Leverington et al. (2010) and Gibson & Marks (1995), an increase in staff density, regardless of training (Bruner et al. 2001), will result in more effective protection of PAs.

External Factors

Development level

Macroeconomic factors such as gross domestic product (GDP), which can be utilized as a proxy for the development level of a country, have a documented impact upon conservation, the efficacy of PAs, and deforestation. Several studies have found that as economic development progresses, the amount of protected land and type of protection is influenced (Barbier & Cox 2003; McDonald & Boucher 2011). In particular, countries with a higher per-capita GDP have more land set aside for protection, as well as a larger proportion of the protected land under "strict protection," or an emphasis on preservation of the natural ecosystem and minimal resource extraction, than their poorer counterparts (McDonald & Boucher 2011). Additionally, one study found that there was an average twenty percent decline in the amount of land protected among the countries with the lowest per-capita GDP, less than $1,500 (McDonald & Boucher 2011).

Nonetheless, the influence of economic development upon deforestation is more ambiguous, with evidence for both beneficial and deleterious consequences. In some cases, economic development has an observable ameliorative effect upon deforestation rates, as exemplified through an analysis of world mangrove loss (Barbier & Cox 2003). Increasing GDP is associated with more intact mangrove areas within countries, with each 10% rise in GDP correlated with a 6.5% rise in mangrove area across all countries examined in one study (Barbier & Cox 2003). Such a correlation is likely attributed to the reality that developing economies

usually become less dependent upon primary sector activities, or activities that rely upon natural resources, as development progresses (Barbier & Cox 2003).

Nevertheless, economic development's negative impacts upon conservation efforts and PAs are also documented. For instance, development may allow more investment in infrastructure such as roads, which may provide accessibility to forests and thus possible exploitation of the forests (Barbier & Cox 2003; Bruner et al. 2004). Moreover, though still under considerable debate, the Environmental Kuznets Curve hypothesis, which hypothesizes an inverted-U relationship between environmental degradation and economic development, has literature supporting it in some aspects (Dasgupta 2002; Dinda 2004). The hypothesis rests upon a model whereby environmental pressure is greatest at the earliest stages of development and eventually decreases as higher income levels are attained (Dinda 2004). Moreover, the hypothesis posits that people with a higher income will have a higher demand for environmental quality, a preference for environmental regulations, and more ability to invest in cleaner technologies (Barbier & Cox 2003; Dinda 2004). In other words, environmental protection climbs the priority totem pole only as more fundamental economic needs, such as food security or basic development infrastructure, are fulfilled; before this point, allotment of scarce monetary resources toward environmental conservation may be seen as a luxury (Deng et al. 2010; McDonald & Boucher 2011; Myers et al. 2000; Oliveira 2002). Hence, development in its earlier stages has observed deleterious effects upon the environment and thus conservation.

Moreover, the macroeconomic factors of GDP and development come into play due to their weighty influence upon PA funding. While *external* factors such as non-governmental organizations, nonprofit organizations, private organizations, and international sources all contribute to the funding of PAs, the main source of PA funding is a country's *internal* resources, namely its own government budget (Oliveira 2002). Accordingly, it follows that wealthier countries with higher revenues, with GDP as a proxy, will have more resources to allocate toward conservation if they choose to do so. Moreover, due to a prevalent "market failure," whereby traditional markets do not capture all of the not-easily-monetized benefits that PAs provide to society, such as watershed protection and a genetic bank, the benefits of PAs are often not fully realized, and the juxtaposition of the monetary costs of protection next to more ambiguous, not-easily-monetized benefits of protection may result in nonsupport of PAs (Dixon

& Sherman 1991). Hence, government investment in PAs is often required due to such forces and may be more apt to meet its obligations given more revenue stemming from more development.

As demonstrated by GDP and development's weighty and intertwined roles with conservation and deforestation, the literature suggests that macroeconomic factors such as development cannot be isolated from conservation strategies (Oliveira 2002).

Population

For conservation zones, the various population dynamics of an area are strong influences on the pressures, threats, and potential for success of that zone. The two factors incorporated into the population category are the country's population density and urbanization percentage. Various studies have shown that urbanization is a strong pressure to conservation zones, both to the land and to the biodiversity (Cincotta et al. 2000). The movement of people to cities is related to increased deforestation in the tropics mainly because of the associated rise in demand for meat, processed food, timber, and other materials from city dwellers (DeFries et al. 2010). Therefore, high population densities and urbanization rates are predicted to have a strong influence on management attributes that involve interactions, pressure, and input from the surrounding lands, such as "GS4: Contact with neighbors" and "MP10: Status of land tenure in surrounding communities." It is likely that there will be competition for land uses and resources surrounding the PA that can be utilized for commercial and economic purposes (DeFries et al. 2010). The pressures on the natural resources that accompany high urbanization will cause disagreements in the status of land. The pressures may also give more incentive to the PA sites to step up their land boundary demarcations (limits) and monitoring in an effort to offset the threats (McKinney 2002).

There is also a high predicted impact on attributes associated with biodiversity, since urbanization and its associated demands have been shown to be one of the most threatening processes to biodiversity loss, significantly decreasing numbers of rare, unique, and native species. One study found that species with more urbanized ranges were considerably more likely to be on the IUCN Red List (McDonald et al. 2008). Therefore, high stress on biodiversity from urban areas demands much higher biodiversity research needs.

Management attributes related to budgeting and funding may be influenced by population, since it has been shown that closer proximity to urban areas present much higher costs for conservation efforts, and thus the site may be less likely to be able to fully budget these costs (Balmford et al. 2003). High population scores may be beneficial for staffing and infrastructure, generating easier access to labor, materials, construction, and other similar components necessary to build up the infrastructure of a site (Hecht 2005). A large workforce should ensure an adequate supply of labor at a lower wage rate and a larger selection of qualified and educated workers. Overall, research has shown that the urbanization rate in a country is a much larger influence on PAs than population density itself, since large rural populations do not necessarily correlate with biodiversity and forest loss (DeFries et al. 2010).

Growth

Human population growth and migration will generate two billion new urban residents by 2030, and 70% of the global population will be urbanized by 2050. The majority of this growth will occur within less developed nations (McDonald et al. 2008). Growth is a powerful influence on conservation zones; the threats, pressures, and influence it exudes overlaps in many areas with the "population" category. The external factors taken into account for Growth are "urbanization growth" and "population growth rate". These growth rates need to be taken into consideration when managing conservation since, as of 2000, the rates in the world's hotspots (1.8%) are significantly higher than both average global growth rates (1.3%) and average growth rates of developing nations (1.6%) (Cincotta et al. 2000). High growth rates and impinging urbanization means higher demand for development, agriculture, and resources. Thus, like Population, Growth will have a strong influence on management attributes that involve interactions, pressure, and input from the surrounding lands as people and their demands further encroach and threaten PA's and surrounding wilderness. The rates also predict future conditions for a given nation. So if the nation expects a larger demand in the future, it may not engage in long lasting contractual agreements and land contracts in order to have the potential to develop the land in the future (Cincotta et al. 2000). The change in growth and urbanization will influence whether the management plan needs to be re-evaluated to adapt to the changing population and their demands. The effects on labor and budget/cost attributes will be similar to the Population

category, with possible benefits from larger labor forces but also higher costs associated with larger populations (Balmford et al. 2003).

Growth is also predicted to have high impacts on attributes associated with biodiversity. Studies suggest that significant biodiversity degradation will be associated with current and upcoming urbanization (Mcdonald et al. 2008). As with population, the urbanization rate should be more of a concern to management than the growth rate itself, since urbanization, cities, and their demands have been shown to be much more influential in biodiversity loss and deforestation than rural populations (DeFries et al. 2010).

Exports

A countries economic reliance on its natural resources can be reflected by the primary exports of that country. Agriculture is one of the largest threats for competing land use in developing countries. Other major causes of deforestation include logging and mining (Hecht. 2005). Thus, a nation whose economy relies heavily on agricultural products, timber, or mined resources will have considerable pressure put on its natural resources and the protection of those resources (Young et al. 2008). Conservation zones in countries with major natural resource exports are predicted to have a number of PA attribute measurements impacted. Attributes reflecting legal contracts and binding of land may be negatively influenced since a nation that has economic investment in its natural resources may be less willing to lock up potential exports for a significant amount of time. Economic development will challenge land conservation (Young et al. 2008). Management attributes that involve interactions, pressure, and input from the surrounding lands and peoples may also be affected. There is an increased chance that surrounding areas of the PA are being managed by other interests, and thus there will be more contact with neighbors. Industries may put pressure to have a greater input into management decisions to try to influence potential economic gain. As well, the high demand for the land and its resources create a greater chance for disagreements in the status of land tenure in surrounding communities that include conflict over the area that comprises the site (Young et al. 2008).

Management attributes related to biodiversity may also be influenced by the nation's dependence on its land and resources. In the past few decades, logging operations have become increasingly international, moving rapidly into many of the developing countries that host

conservation zones (Laurence et al. 2000). In themselves, over-logging, burning, grazing, mining and commercial hunting have extracted or degraded natural resources, abetted biological invasion or polluted soil and water resources. But even the indirect consequences of these activities are harming biodiversity. The roads and infrastructure made to extract the resources lead to fragmentation. Many studies have made it clear that animal populations are significantly influenced by ecological changes in fragments and edge effects (Laurence et al .2000). The acquisition and expansion of resource use puts mounting pressure on ecological populations already negatively impacted by the activities themselves. Examining a nation's exports is a way to estimate the dependence on local natural resources and the conflict between economic gains and conservation efforts.

Education levels

There is a correlation between high levels of primary education and the amount of protected land across countries. In countries where its populace has high levels of primary education, land is protected quicker than in countries with medium or low levels of primary education (McDonald & Boucher 2011).

Moreover, higher levels of education are associated with higher environmental awareness and understanding, as well as more positive attitudes toward conservation (Keane et al. 2010, Tomićević et al. 2010, Liu et al. 2010). For instance, levels of awareness regarding protected areas are measurably higher in individuals with higher education levels, a connection to tourism, and involvement in resource management at the community level (Keane et al. 2010). Additionally, in a case study of Madagascar, individuals with higher education levels proved more competent at correctly classifying protected species into legal categories and thus had higher knowledge of the legal aspects surrounding conservation (Keane et al. 2010). Furthermore, pro-ecological beliefs and favorable attitudes toward conservation were correlated with higher levels of education (Kean et al. 2010, Tomićević et al. 2010). Moreover, one study documented that individuals with less education were more likely to have dissatisfied attitudes toward protected area management, a more negative perception of the relationship between the protected area and the community, and a higher likelihood of having conflicts with the conservation (Liu et al. 2010).

The implications of education levels are particularly relevant in a discussion of local input into management decisions. If the local people are educated and possess the necessary knowledge and skills to fulfill their duties as conservationists, as well as an understanding of the environmental and social incentives at play in the community and nation as a whole, then they are a potentially valuable resource as staff and disseminators of information to the community (Colchester 1994). Moreover, when the local population possesses the education and expertise to be effective conservationists, the need for outside funding and management is reduced, and because funding is a scarce resource, this benefit is substantial (Colchester 1994).

Hence, in this manner, broad socioeconomic factors such as education influence conservation efforts through its correlation with the establishment of more protected areas, the speed at which the protected areas are established, the molding of more positive attitudes toward conservation, the heightening of conservation awareness, and the implications upon the incorporation of indigenous populations as conservation staff.

Tourism

Since the 1990s, ecotourism has been touted as the win-win solution to both poverty alleviation and conservation funding shortfalls (Ferraro & Hanauer 2010; Butcher 2010). Studies have shown that the presence of tourism at PAs has significant positive effects on finances (funding, budget plans), park infrastructure, and the legal status of parks. The socio-economic benefits of ecotourism vary from nil to significant, depending on the financial plan in place at the individual PAs.

Tourism and funding for PAs are highly related (Kangas et al. 1995; Butcher 2010). Parks frequently move from operating in the red (monetary loss), to turning a profit shortly after tourism programs are implemented. For example, the Protected Area at Possum Point, Belize saw economic inputs skyrocket in the two years after implementing an ecotourism program. The site's net cash balance of income and outputs jumped from -$6670 to +$4811 over that two year period (Kangas et al. 1995). Funding from tourism comes in the form of permit fees, camping fees, entrance fees, guide hiring, lodging costs, as well as donations from tourists. Volunteer ecotourism also is a source of income and labor. Funding is one of the most important factors in the survival of conservation areas, with the "success or failure of PAs correlates highly with

funding availability (Leverington et al. 2010). Funding allows PAs to hire more staff, repair and construct infrastructure, and conduct monitoring.

Funding provides a means for the improvement of most attributes associated with PAs; however, other attributes are directly enhanced by tourism as well, such as infrastructure. According to McNeely et al. (1992), “there is no doubt that the introduction of tourism to parks increases infrastructure.” Tourists require adequate lodging with amenities, well-maintained roads and trails, and an aesthetically pleasing experience. Because of these needs, infrastructure improvements are inherent in a PA that caters to tourists.

Additionally, parks are enhanced legally by tourism. For instance, site boundaries are better delineated, maintained, and respected when tourism is incorporated into site plans. These sites are more likely to have a binding contract for protection of biodiversity, and formally declare conservation of biodiversity as an official goal (Wang & Buckley 2010). Sites with tourism are also more likely to be legally gazetted (legally publicized). In one extensive survey-study, researchers found that "legal support capability" was significantly enhanced by tourism inputs (Wang & Buckley, 2010). The business of ecotourism generates contracts and financial agreements with a myriad of entities. The practice of reimbursing local communities for their land/aid is not uncommon, and contracts almost always facilitate these transactions. Agreements with the PA and third party tourism companies are also contract-based (Nelson 2010). Tourism, as with any business venture, requires contracts and legal support.

Nonetheless, within the PA literature, there is controversy over whether tourism presents a net benefit or net harm to conservation efforts. Experts seem to be split. On the one hand, tourism provides funding which can enhance conservation and promote sustainable development (Reed 2008). On the other, tourism can significantly increase foot traffic into fragile ecosystems, (Reed 2008) pollute pristine areas with waste, and even introduce invasive species (Wang & Buckley 2010).

Climate Anomalies

Studying climate, climate change, and extreme weather events in PAs is increasingly becoming an important factor in habitat conservation. Droughts, floods, or other climate anomalies will affect the land of the PA, the inhabitant species, and the neighboring

communities. Sudden alterations in climate in the past and future climate change projections show that changes in weather can result in landscape changes over small time frames (Hannah et al. 2002). It is crucial to integrate climate changes with PA management decisions (Lemieux & Scott 2005) to effectively account for alterations in topography and biodiversity.

The effect of climate changes on PA management occurs on every level of PA planning. At the initial stages, research must be done to identify areas sensitive to climate anomalies and conservation management plans must contain adaptation plans that integrate climate threats and emergency disaster mitigation (Welch 2005). Potential climate changes must be anticipated and accounted for in original management plans. Location of PAs must consider climate change by avoiding fragmentation and including boundary buffer zones (Welch 2005). "Under changing land-use and climatic conditions, static nature-reserve boundaries may fail to encompass the climatic ranges of species that they were intended to protect," and boundaries can account for this by including corridors and buffer zones and maximizing variation of climatic features (Halpin 1997).

As a site develops, PAs can benefit from periodic monitoring of the relationship of climate with biodiversity (Welch 2005). Extreme weather events at a specific point in time can drastically change a site, so continuous evaluation is necessary as a site changes. A PA with extreme drought conditions in 2009 must be monitored and management style can be appropriately altered in 2010 to exert maximum conservation.

Knowledge and awareness of possible climate anomalies is essential for the staff, stakeholders, and the general public (Welch 2005). With changes in climate in a hotspot, local communities can have a big impact on whether the site continues to conserve the land. Communities near the PAs are impacted by the climatic changes as well, and they must adapt the way they use the land's resources; social education for climate change adaptation can help ensure the site continues to be conserved (Tompkins & Adger 2004). Awareness programs, staff training, and local input into the site anticipates all types of PA modifications, including climate changes, so staff and neighboring communities will know how to adapt to any external changes, whether social, political, or environmental.

Variations in climate have had a large effect on the Amazonian forests (Laurance & Williamson 2001). Dry seasons can be intensified by El Niño-Southern Oscillation droughts and increase the risk of forest fire; changes in land-use must be made to stop the growing levels of forest fires (Laurance & Williamson 2001). A result of the deforestation is that smaller droughts could have greater consequences – forest fires across the Amazon forest could create significant carbon emissions, increasing global warming (Laurance & Williamson 2001). Extreme droughts greatly increase deforestation levels and could potentially have a cyclical effect, generating higher temperatures and a higher number of droughts, leading to record low forest coverage. Climate anomalies must be considered in conservation strategies to ensure successful deforestation prevention with any major alterations in topography of a PA.

Topography

The topography of a site often determines the general type of protected area (PA) and the biodiversity within that PA (USAID 2007). PAs exist to conserve the biological diversity of an area, and topography is the major factor determining all internal characteristics of a PA. Complex topographies within sites must be separated in order to determine the distribution of endemic species within different forest formations (Helmer et al. 2002). The type of land correlates with the inhabiting species and the resources that exist within the PA boundaries; therefore, the type of land correlates with use and degradation of the land.

Land type of a site strongly impacts deforestation and the threat level of a PA. Topography, specifically terrain slope and accessibility, strongly relate to the amount of canopy cover in the Atlantic Forest (Freitas et al. 2010). Land accessibility, level of demands for forest resources, amount of roads and agriculture, and locals' land-use are certain factors that can determine an area's level of deforestation, and the biodiversity that the topography houses determines how prevalent these factors are (Freitas et al. 2010).

Each PA is unique and has specific needs based on its topography, and thus the organizational structures must be created to meet the diverse requirements of each PA to be successful. The 78 PAs studied had a range of topographies from marine protected areas to tropical rainforests, and the majority of PAs contained multiple land types within their boundaries (CI GCF 2010). Management of a PA must be based on the specific topography in

order to effectively conserve the unique combination of forests and species existing within the boundaries, making management plans and monitoring systems crucial for effectively restoring land areas (Jeanneret et al. 2003). Recording changes in topography over time to see if deforestation rates are decreasing and subsequently modifying management plans can help ensure maximum conservation.

Biodiversity

Preserving biological diversity is a fundamental benefit of establishing PAs (Dixon & Sherman 1991). The biodiversity of each PA is the number of different species, flora and fauna, that exist within the boundaries of the PA. In this study, biodiversity was characterized as number of endemic species and number of "higher" threatened plant species, according to the World Bank. The t3otal number of endemic species included vertebrate plants, mammals, birds, reptiles, amphibians, freshwater fish, marine fish, and swallowtail and milkweed butterflies, or any combination of these species with information available online.

Biodiversity is an important factor in PAs as the amount of species directly correlates with the type of land and the size of the PA. In addition, many PAs are created specifically for certain types of species, such as Important Bird Areas, and may even target one or two distinct species (CI GCF 2010). When PAs are targeted at specific species, the unique biodiversity has a similar effect as topography on internal aspects of the PA. Biodiversity has a major impact on the establishment and maintenance of a PA as the management plans must be refined for the diverse needs for species conservation at each specific site. Presence of endemic and threatened species in a PA must be known to effectively attempt to conserve these species. Many species require several adjacent habitats during their entire life-cycle (Jeanneret et al. 2003) and all of these habitats must be accounted for when determining the size and boundaries of a PA. As such, the boundary and surrounding area of a PA are equally important for biodiversity conservation as the PA itself;

People on local and global scales can rely on the natural resources of a PA. "Biological resources form the basis of large numbers of industries and are important sources of food, medicines, chemicals, and other products used in both traditional and industrialized societies," and maintaining PAs protects the species and resources of the land (Dixon & Sherman 1991).

Resources from the land can be used by neighboring communities, and the people in these communities must be incorporated into the management processes of PAs to ensure conservation. CI takes the social and cultural livelihoods of neighbors into account when developing PAs (CI 2010). The residents near the site have a direct effect on how the resources are used, and management decisions and education should be provided to increase their knowledge and change their habits of how they use the land of the PAs.

Deforestation levels strongly affect changes in biodiversity of an area (Pandit et al. 2007). Loss of forest cover will specifically impact large species and forest-specialized species (Pandit et al. 2007). Increasing deforestation will fragment habitats, negatively affecting biodiversity conservation as species' ecosystems are destroyed. Monitoring the success of sites and reevaluation of management plans is necessary to ensure biodiversity conservation is achieved over time (Jeanneret et al. 2003). Updating administration of a PA, based on amount of deforestation or other external influences on the land, can reassess the existing species and the best management practices to conserve them.

Forest and Local Economies

Most indigenous peoples rely heavily on natural resources, and most live in remote areas that have been designated as national parks or other types of protected areas (Nepal, 1999). Consequently, relationships between conservationists and rural communities have been troubled in many protected regions. For instance, in an effort to effectively conserve the natural environment, certain protected area authorities enforce strict restrictions without participation from the inhabitants of the region. In a case study examining the complexities of participatory conservation in resource management programs, it is argued that high level of community involvement encourages effective integration of conservation and development projects (Hough 1991). In the case study, villagers were coerced into displacement from their homes. The imposed policies created strained relationships between indigenous peoples and conservation authorities and showed negative impacts on the effectiveness of the protected area (Hough 1991). Restricting involvement of indigenous peoples limited the forms of participatory conservation that could surface.

The establishment and enforcement of protected areas prove to be successful methods of maintaining biodiversity and have potential to achieve long-term conservation of biological diversity. However, enforcing protected area boundaries is costly and labor intensive, especially if land is highly valued for agriculture or forestry, or if local threats are expensive to mitigate (Brooks et al. 2006). Nonetheless, certain protected areas formed mutual agreements between the affected communities and conservation authorities to successfully implement new controls to improve biodiversity. Such sites actually improved the livelihoods of forest dependent people and still showed protection of the area from development or misuse (Hardin 2009). In eleven case studies evaluating different institutional framework of protected areas, researchers concluded comprehensive participation of indigenous peoples was necessary to effectively restore biodiversity in degraded landscapes (Beltran 2000). By allowing participation of the resident indigenous peoples in protected areas, management programs ensured the conservation of the ecosystem and long-term improvements of the conditions for the community.

Recognizing the social and economic requirements of communities enhances cooperation of forest related concerns. Effective implementation of the management plan requires negotiations with citizens living near conservation sites to make sure that their policies better integrate biodiversity considerations (Lasimbang 2004). The Environment Protection and Biodiversity Conservation (EPBC) Act recognized the connection between conservation and the lives of the local community and was implemented to ensure that ensure that indigenous interests are addressed when developing management plans. The Act was instated to safeguard a balance between the community's demands for forest products and preservation of forest biodiversity.

An effectively managed protected area is one that has developed an approach to ensuring local communities derive benefits from conservation. Where indigenous and other traditional peoples' participation in management has taken place early in the planning process, there have been benefits for both the indigenous peoples and the management authorities (Towsend 1998). To ensure long-term sustainability of the protected areas in which they live or have an interest, Conservation International management should concentrate on widening the participation of the indigenous and other traditional peoples in all aspects of management. In those areas in which some type of co-management is already taking place, the challenge is how to reinforce and

extend the mechanisms. In sites where indigenous and other traditional peoples do not participate in the implementation of management plans, the challenge is how to make it happen.

Broad Discussion of Findings and Concluding Remarks

Our findings, which are based on a thorough examination of literature concerning PA best management practices, indicate that certain attributes are more correlated with PA success than others. We found that funding, well-implemented monitoring systems, management effectiveness evaluations, security and law enforcement, and community involvement in management are stressed as critical factors for PA success. These findings suggest that the selected attributes present the best funding opportunities for organizations such as CI. This research provides us with a comprehensive understanding of management attributes and provides a qualitative reference for comparison to our quantitative results. Moreover, the findings demonstrate that external factors other than management attributes affect conservation efforts.

V. Methodology

Data Selection

Conservation International provided a series of data sets regarding management attributes and protected area site descriptions. In order to achieve the most cohesive data set, only protected area sites for which information was available regarding site descriptions, management attribute scores, and a three-year time span from 2008 to 2010 were included for further analysis. After eliminating sites that did not fulfill all three data criteria, the data set amounted to 78 sites which spanned 16 countries.

External Research

Recognizing that macroeconomic and socioeconomic variables are capable of influencing internal site management variables, broad cultural, economic, and environmental factors were investigated by the research team. The cultural external variables considered included education levels, population size, urbanization, and population growth. The economic external variables considered included development level of the country in which the sites were located, the presence and nature of forest and local economies, exports of the country, presence of green tourism, and site size. Finally, the environmental variables considered included an investigation of the topography, natural disasters, climatic events, and biodiversity levels of the areas. Through utilization of public databases such as the World Bank and CIA World Factbook websites, data was collected on a largely country-by-country basis for the countries in which the protected area sites were located.

Additionally, the research team composed a literature review to investigate the relationship between the external variables in consideration and CI's internal management attributes. This research also allowed the team to gain a broader understanding of the direct influence of external variables on deforestation and conservation efforts at CI's sites world-wide. The review can be found in the section titled "Literature Review" of this report.

After gathering such data and conducting the relevant research, the research team hypothesized the strength at which each external variable potentially affects each internal management attribute. Such assessments were recorded in a chart so that the hypothesis could either be confirmed or rejected later based upon the statistical analysis of CI's internal

management attribute data. The hypothesized relationships can be seen in Table VI.2.

Statistical Analysis

Statistical analysis was conducted through the comparison of two data sets. The first data set was provided by CI containing 24 management attributes, of which scores for the desired 78 conservation sites were used. The second set was synthesized from the aforementioned research on the 12 external factors that were quantitative in nature. Since the data in both sets was quantitative, the data team conducted statistical and graphical correlation tests and further analysis. The CI data set was initially organized into charts which allowed the numerical data to be easily readable, and trends were quickly noticed.

The first set of charts for the 24 management attributes communicated the distribution of the scores and the trends of score changes over the three year period. Since the external data was relatively consistent for all three years, an analysis of the effects of the external factors over the period would be inconclusive. Therefore, the overall distribution of CI's scores was taken into account greater than the change in scores from year to year. Nonetheless, all three years of management attribute data were included when combined with the external factors as this allowed for more data points, thus making the data more robust and valid.

In order to conduct the statistical analysis necessary for this data, the management attributes were narrowed to include only the ones that exhibited a monotonic trend in scores based off of their distribution charts. Each management attribute was compared to a single external factor by focusing on one management attribute at a time, and creating multiple spreadsheets. The management attribute scores over all 78 sites were sorted lowest to highest, and the scores were typically on a range of zero to one or zero to three. Next, the external factor values that directly correlated to each site were averaged by attribute score. Two-tailed t-distribution tests were required to decipher which correlations between the two data sets were statistically notable. However, the test required the comparison of only two values from the external data; the two external factor scores related to the two management attribute scores that showed a monotonic trend in the distribution charts were chosen. With the t-test, $p < .05$ was the cut off of value indicating a risk of 5 percent error when confidently determining a relationship between the external factor and the management attribute from the two scores.

After narrowing the data to the external factors that exhibit a notable change over the selected scores of each management attribute, new charts were created to linearly overlay this external data for ease of interpretation. These charts allowed for an analysis of how the management scores adjust with changes in external factors. The results provided a larger understanding and prediction of how CI's site management might be affected by external factors especially when considering trends across multiple sites and multiple countries.

After this data was collected and the graphs were compiled, the results were arranged into another spreadsheet that presented how each external factor affected the spread of management attributes. The table synthesized the findings of the 127 graphs to communicate the large trends between both data sets. The graphs indicated whether the monotonic trend of the two selected scores were increasing with a, greater frequency of the higher management attribute score, or decreasing with a greater frequency of the lower score. The correlation of the external factors was indicated as either having a direct relationship or indirect relationship. In a direct relationship the line on the graph representing the external factor trend paralleled the attribute score trend, whereas an indirect relationship assumed an opposite trend. The charts revealed the extent and manner of impact for each external factor. The analysis of the external factors and their data for each country was constructed into a useful rubric as to what management attributes might be affected and in what way depending on the site and country.

VI. Results

Table VI.1: List of Attributes, and their Descriptions

CODE	MANAGEMENT ATTRIBUTE	DESCRIPTION
LR1	Legal Contract in Place	This management attribute is a ranking of how much the site is legally gazetted and/or if a binding contract for protection with biodiversity conservation as an official goal is in place.
LR2	Length of Remaining Contract Time	LR2 is a ranking of how much time the binding contractual agreement has remaining.
MP1	Management Plan in Place	MP1 is a ranking of the extent in which a site has a management plan implemented.
MP2	Species Action Plan	MP2 uses two scores to determine if there is or is not a species action plan for threatened and restricted-range species articulated in the management plan for the site.
MP3	Education and Awareness Program	This management attribute deals with the level of education outreach associated with the protected area so that neighboring communities are aware of the reasons for and the importance of the conservation efforts.
MP4	Monitoring and Evaluation System in Place	This factor scores the adequacy of the system in place at the site, namely if it monitors the threatened species in an effective manner and if data collection seems sufficient for the area.
MP5	Financial Plan in Place	This attribute evaluates whether there is a financial plan in place at the site and if not, if there is one in the works or none at all.
MP6	Business Plan in Place	Similar to MP5, the status of a business plan in the area that is defined to meet the standards of the GCF.
MP7	Periodic Review/Update of Management Plan	This attribute is based on Score 0: There is No review, and Score 1: yes, there is periodic review on the site.
MP8	Biodiversity Targets Identified	This attribute is also a Score 0, Score 1 ranking, with 0 representing the targets not identified and 1representing that targets have been identified.
MP9	Staffing in Place	For this management attribute Score 0 means that there is inadequate staffing in place whereas 1 means that there is adequate staffing in place

CODE	MANAGEMENT ATTRIBUTE	DESCRIPTION
MP10	Status of Surrounding Land Tenure	This management attribute deals with the status of the land and the presence of conflict with neighboring communities due to the status of the land (if it is established as a protected area and locals are in argument with the management).
MR1	Adequate Staff Training and Skills	This attribute measures a sites ability to provide adequate staff training and skills. The education and experience of staff could impact a sites ability to problem solve effectively or have the capability to meet the needs/ goals of the site.
MR2	Appropriate Budget for Identified Management Costs	This attribute indentifies the sites with a budget able to cover management cost and connects the attribute MP1: Management Plan in Place.
MR3	Minimum Infrastructure	This attribute assesses whether sites have the minimum required physical and communicational capabilities to handle management needs.
MR4	Boundary Demarcation (Limit)	In order to establish and monitor a site, proper land boundaries must be determined. This attribute questions the limit of the boundary known by neighbors and management.
RK1	Biodiversity Research Needs	This attributes assess the sites need for research into biological diversity in order to develop an action plan for species, connected to MP2: Species Action Plan.
RK2	Biodiversity Research Needs - Specific	If the site does NOT need additional biological diversity research, the RK2 attribute asks about the specific nature/field of the ongoing/finished research conducted.
RK3	Socio-economic Research Needs	This attributes assess the sites need for research into social economic in order to develop an action plan for species, connected to MP2: Species Action Plan.
RK4	Socio-economic Research Needs – Specific	If the site does NOT need additional social economic research, the RK4 attribute asks about the specific nature/field of the ongoing/finished research conducted.
LT1	Funding	Best stated by CI, LT1 determines the number of years for which the project has secured 100% funding.

Table VI.2: Research Team's Hypotheses of External Factor Influence on Management Attributes

MANAGEMENT ATTRIBUTE	EXTERNAL FACTOR									
	Climate	Topography	Population /Urbanization	Growth Rates	Biodiversity	Education Levels	HDI	GNI	Tourism	Exports
Site legally gazetted and/or binding contract for protection with biodiversity conservation as an official goal (LR1)	Med.	High	Low	Med.	High	High	High	High	High	Med.
Length of binding contractual agreement remaining (LR2)	Med.	High	Low	High	Med.	Low	low	Low	Med.	High
Staff at site with required capacity and resources (GS1)	High	Med.	Med.	Med.	High	High	High	High	Med.	Low
Reporting to Stakeholders (GS2)	High	Med.	Low	Low	Med.	Med.	Med.	Med.	High	Low
Local input to management decisions (GS3)	High	High	Med.	Med.	High	High	Low	Low	Med.	High
Contact with neighbors (GS4)	High	High	High	High	High	Low	Low	Low	High	High

Management plan in place (MP1)	High	High	Med.	Med.	High	High	Low	Low	High	Med.
Species action plan (MP2)	High	High	High	High	High	Med.	Low	Low	Low	High
Education and awareness program (MP3)	High	Med.	Med.	Med.	High	High	High	High	Med.	Med.
Monitoring & evaluation system in place (MP4)	High	High	Med.	Med.	High	Low	High	High	Med.	Med.
Financial plan in place (MP5)	Med.	High	Low	Low	High	Med.	High	High	High	Low
Business plan in place (MP6)	Med.	High	Med.	Med.	Med.	Med.	High	High	High	Med.
Periodic review / update of management plan (MP7)	High	High	Low	Med.	High	Med.	Low	Low	Low	Med.
Biodiversity targets identified (MP8)	High	High	Med.	Med.	High	Med.	High	High	Med.	Med.
Staffing in place (MP9)	Med.	High	High	High	Med.	High	High	High	Med.	Low
Status of land tenure in surrounding communities (MP10)	High	High	High	High	High	Low	High	High	Med.	High

Adequate staff training and skills (MR1)	High	High	Med.	Med.	High	High	High	High	Low	Low
Appropriate budget for identified management costs (MR2)	Med.	Med.	Med.	Med.	Med.	Low	High	High	High	Low
Minimum Infrastructure (MR3)	Med	High	Med.	Low	High	Low	High	High	High	Med.
Boundary demarcation (MR4)	High	High	High	High	High	Low	Med.	Med.	Med.	Med.
Biodiversity research needs (RK1)	Med.	High	High	High	High	High	High	High	Low	Med.
Socio-economic research needs (RK2)	Low	Low	Med.	Med.	Low	High	High	High	High/Low (variable)	High
Socio-economic research needs - specific (RK3)	Low	Low	Med.	Med.	Low	High	High	High	High/Low (variable)	High
Biodiversity research needs - specific (RK4)	Med.	High	High	High	High	High	High	High	Low	Med.
Number of years with 100% funding (LT1)	High	High	Med.	Med.	High	High	High	High	High	Low

External Factor Correlation Result Summaries

Percent of Population Urbanized

This external factor may be inversely related to the success of management attributes. At sites with lower levels of urbanized populations, management attributes were typically more successful. This is most highly expressed for (MP1) Management Plan and (MR3) Minimum Resources attributes. There may be another possible reason for this relationship that has less to do with the decisions of CI. A higher percentage of urbanized population is an indication of lower populated rural areas that tend to be a big stressor on conservation sites. A lowering of this pressure may guarantee more success for these management attributes.

Population Density

The population density of a region may be a good indicator of the presence of Management Plan data for a site. In other words, a high population density tends to result in more successful targets for management plan criteria. This could be attributed to CI focusing its resources on areas with high population density. It is interesting to note that MP10 (Status of Surrounding Land Tenure) even increases its' higher score frequency when population density rises. It may be that population density increases the pressure to have plans in place to better safeguard the site. For LR2 (Length of Remaining Contract Time) and MR4 (Boundary Demarcation), higher population density again is associated with more successful scores suggesting that this external factor is very influential when protecting a conservation site. Population density may be an indicator of where to place resources because it may pose a higher threat to the protection of the conservation site. Population density is a great example of the second method that CI tends to use: placing the greatest effort in locations with the highest levels of threat. We will refer to this methodology as preventative measures.

Urbanization Rate

For the majority of management attributes, especially those pertaining to management plans, higher urbanization rates are strongly correlated with better scores. So even though the majority of the sites have low scores and are in poor condition, higher urbanization rates may be

a way to improve. This is similar to the population density in the way that their increase in extent may be good indicators as to where CI should best place its efforts.

There are two exceptions to this trend for urbanization rates, LR2 and MP10. LR2 is a tally of how many years are left in a binding legal contract for the conversation site and so this is not necessarily a negative correlation. Urbanization Rate is lower in areas that have more than 20 years left on the binding contract, whereas it is higher at sites that have less than a year remaining. This has two possible meanings. CI is aware of the impacts of urbanization rates and believes that lower urbanization rates will guarantee more success and thus they invested their energy in implementing long-term legal contracts at these sites. An alternative to this is that CI wants to place their efforts in areas more at risk like they have for the other management attributes; therefore, they are misappropriating their resources when it comes to the length of legal contracts. The other exception, MP10, falls to the same conclusions as LR2. Lower urbanization rate correlates to better boundary demarcation indicating a higher awareness of the impacts of urbanization rates or a possible misappropriation of resources.

Growth Rate

This external factor is not as consistent in the ways it correlates to the management attributes, as was Population Density, Percent of Population Urbanized and Urbanization Rate. Higher population growth rates were highly associated with better scores for management attributes MP2-MP4, MP8, MR1 and MR4. On the other hand, lower population growth rates were highly associated with better scores for MP1, MP5, and MP10. If CI is using growth rates as an indication as where to place their resources in management attributes, this data expresses that they should be focusing more resources on MP1, MP5 and MP10. This seems to be the case because if CI were choosing sites with low growth rates in order to guarantee success, their efforts would have been squandered as expressed through MP2-MP4, MP8, MR1 and MR4.

Human Development Index

The majority of the Human Development Index scores are defined as decreasing, and therefore lower scores are more prevalent amongst the sites than higher scores. Also, the management attributes that were noted as increasing correlated with factors that took into account time and space such as length of contract and boundary demarcation, rather than

management effectiveness with staffing and planning. Since the majority of the management attributes had a decreasing, direct relationship with HDI scores, this indicates that a higher human development index is related to a lower CI management score, and this frequently takes into account factors like management planning and budget planning. The majority of the countries in this study have a below-average HDI score to start, however it is interesting that higher HDI scores are closely correlated with a greater distribution of lower management scores. It is possible that CI made the assumption that conservation sites in countries with higher HDIs are more capable of effective self-management, therefore, CI fell short in implementing management plans, systems of updates, reviews and evaluations and ensuring there was adequate staffing. The graphs and t-tests conducted in this study are revealing of where CI should necessarily improve current management.

GNI per Capita

Since all of the management attribute relationships with this factor fell under the category of "Increasing Inverse" or "Decreasing Direct," there was consistently a higher GNI value associated with the lower of the two management attribute scores, despite which score had the greater distribution. The results demonstrated by the correlation chart are almost identical to the relationship between the Percent of Population Urbanized factor and the management attributes. This can be attributed to the trend that occurs as a community or country increases in urbanization: the average wage for the citizens rise and therefore an overall increase in GNI ensues. Some of the attributes that received a greater number of higher scores than lower dealt with policy issues like legal contracts, land status, and boundary demarcation. Nonetheless, the fact that all of the attributes saw a higher GNI with the lower of the two scores could allude to the trend that as countries make more money they invest in the well being of the environment less. As countries become more industrialized, it is easy to exploit the land rather than remember the origin of the wealth and the necessity of sustainable resources.

Education Levels: Literacy Rate

This external factor showed a notable relationship to only seven of CI's management attributes when the t-tests were conducted. Five of these management attributes were decreasing direct, and they all dealt with the presence or lack of management plans, whether in terms of

budget plans, species plans, etc. It is very surprising that sites with a higher literacy rate were associated with a greater frequency of lower management scores. It was previously assumed that sites in countries with higher literacy rates would be more capable making business and financial plans. However the opposite is true; the literature review includes case studies explaining how locals in surrounding communities were often seen as unqualified for protected area management, however they tended to be very knowledgeable of the land that they live off of and sensitive to the importance of sustainability. This trend could be a factor in the reason behind a higher management attribute score associated with a lower literacy rate. Nonetheless, CI should not assume that a site located in a country with high literacy rates is capable of implementing and carrying out management plans, but rather requires increased support and attention.

Education Levels: Education Expenditures

Six out of the ten management attributes correlated to education expenditures were classified under the "decreasing direct" category. There are less of the higher, more desirable scores in this category, and the Education Expenditures are higher in sites that had a lower management score. This is also an interesting and worrisome trend. Usually a lack of adequate staffing is correlated with a lack of funding. It seems, however, that while more money (as compared to the country's GDP) is being allocated to education, the money is not effective in terms of management on sites. A break in the link between this external factor and CI's management attributes occurs as it is unknown where exactly the education funding ends up and whether or not it is related to environmental education and conservation issues. It is also interesting to note that Education Levels: Education Expenditures and Education Expenditures: Country Compared to World have opposite trends across all of the management attributes.

Education Expenditures: Country Comparisons (Out of 186)

The education country comparison increased in 9 out of the 10 notable t-tested management attributes when correlated with education comparisons. The t-tested attributes within the Management Plan (MP) section and MR1 (Adequate Staff Training) from the Minimum Resource section all show a decrease across the three years, with an increase in education comparison. This strongly contradicts the assumption that an increase in education expenditure would result in an increase in management planning and expertise. Contrarily, the

MP10 (Status of Land Tenure) attribute increased while the education comparison decreased. In support, MR4 (Boundary Demarcations) increased while education comparison decreased. The status of land tenure and the land boundaries can become very judicial in nature, with a need for a higher educated population. CI might provide such legal support in countries that do not have such qualified professionals. Another explanation could be that the education comparison of countries does not include the actual values of GDP spent on education, and that these numbers might be important.

Number of Endemic Species

The most surprising of all external factors results are the ones from the number of endemic species. All 12 of the important t-tested management attributes show a decrease in the number of endemic species. How could this be? Eight of the 9 MPs decreased in all t-tested results while the number of endemic species decreased in every instance. MP10 increased, but the number of endemic species still decreased. Within the Minimum Resource attribute section MR1 (Adequate Staff Training) decreased, MR2 (Appropriate Budget) and MR4 (Boundary Demarcation) increased over the three years, all resulting in a decreased in endemic species. These results speak loudly to an ongoing problem in conservation. Endemic species have traditionally been a strong indicator of conservation success and focus in CI funded literature, the number of endemic species tends to be lower in sites that have such success (according to CI's assessment). CI's method of determining success is therefore not including the entire picture of the health of their conservation site.

Number of Higher Threatened Plants

Out of six t-tested results, the number of threatened plants factor depends on the specific management attribute. While Legal Recognition LR2 (Length of Contract Time) increased, the number of threatened plants also increased. It seems to be important to have a long protection contract time as the number of threatened plants (and possibly other life such as invertebrates) increases, allowing sites with the highest threats remain protected. Four of five attributes in the MP section decreased while there was a decrease in the number of threatened species of plants. As the number of sites with foundational management plans decreased over the three years, similarly, the number of threatened plants at the respective site decreased. The need for a

satisfactorily functional management plan may be highly influenced by the need for threatened plant protection. MP6 (Business Plan) decreased in scores as the number of threatened plants increased. This particular management plan attribute stands alone from the rest in the MP section, probably making its impact in the protection of threatened plants distinguished.

Employment in Agriculture

The percentage of employment in agriculture is commonly used as an indicator of overall employment within a country. It is important to keep in mind that an increase of employment in agriculture could stem from a decrease in jobs available in other sectors. Within the MP section the t-tested attributes MP5 (Financial Plan) and MP7 (Update of Plan) had an overall decrease, while the percentage of agricultural employment increased over the three years. Interestingly, financial planning and employment in agriculture shows an important demand for skilled financial professionals but the supply of those able to work with agriculturally-based products. MP8 (Biodiversity Targets) decreased while the employment decreased. As sites decrease in biodiversity targets, the employment rate decreases. The lack of established biodiversity targets might stem from a more pressing need for an economic revival and thus an increase in resource extraction coupled with less protection. In the MR section, MR2 (Appropriate Budget) increased along with the employment in agriculture. Once again, the need for proper financial provisions and strength could help explain the reason why sites that have appropriate budgets are within countries with higher employment. MR4 (Boundary Demarcation) increased, with a converse decrease in employment percentages. Although boundary demarcations (limits) are in the Minimum Resource section, these limits have more legal necessities. Countries with sites that have legal resources might tend to have more jobs available in sectors other than agriculture, resulting in the decrease.

Table VI.3: Characterization of Significant External Factor Correlations with Attributes

EXTERNAL FACTOR	CORRELATION TYPE			
	INCREASING DIRECT	**INCREASING INVERSE**	**DECREASING DIRECT**	**DECREASING INVERSE**
Population Density (People/km^2)[1]	**LR2:** Length of Remaining Contract Time **MP10:** Status of Surrounding Land Tenure **MR4:** Boundary Demarcation	*No significant correlations of this type were found.*	*No significant correlations of this type were found.*	**MP2:** Species Action Plan **MP5:** Financial Plan in Place **MP7:** Periodic Review/Update of Mgmt Plan **MP8:** Biodiversity Targets Identified **MP9:** Staffing in Place
Percent of Population Urbanized [2]	*No significant correlations of this type were found.*	**MP10:** Status of Surrounding Land Tenure **MR2:** Appropriate Budget for Identified Mgmt Costs **MR4:** Boundary Demarcation	**MP2:** Species Action Plan **MP4:** Monitoring & Eval System in Place **MP5:** Financial Plan in Place **MP6:** Business Plan in Place **MP7:** Periodic Review/Update of Mgmt Plan **MP8:** Biodiversity Targets Identified **MP9:** Staffing in Place **MR1:** Adequate Staff Training and Skills	*No significant correlations of this type were found.*
Urbanization Rate [3]	**LR1:** Legal Contract for Conservation as Goal **MR4:** Boundary Demarcation	**LR2:** Length of Remaining Contract Time **MP10:** Status of Surrounding Land Tenure	*No significant correlations of this type were found.*	**MP1:** Mgmt Plan in Place **MP2:** Species Action Plan **MP4:** Monitoring & Eval System in Place **MP6:** Business Plan in Place **MP7:** Periodic Review/Update of Mgmt Plan **MP8:** Biodiversity Targets Identified **MP9:** Staffing in Place **MR1:** Adequate Staff Training and Skills
Growth Rates	MR4: Boundary Demarcation	LR2: Length of Remaining Contract Time MP10: Status of Surrounding Land Tenure	MP5: Financial Plan in Place	**MP1:** Mgmt Plan in Place **MP2:** Species Action Plan **MP4:** Monitoring & Eval System in Place **MP8:** Biodiversity Targets Identified **MR1:** Adequate Staff Training and Skills

[1] (as of 2008 via World Bank)
[2] (from CIA World Factbook 2010 data)
[3] (in % annual rate of change from CIA World Factbook)

EXTERNAL FACTOR	CORRELATION TYPE			
	INCREASING DIRECT	**INCREASING INVERSE**	**DECREASING DIRECT**	**DECREASING INVERSE**
HDI scores [4]	**LR2:** Length of Remaining Contract Time **MP10:** Status of Surrounding Land Tenure	**MR2:** Appropriate Budget for Identified Mgmt Costs **MR4:** Boundary Demarcation	**MP1:** Mgmt Plan in Place **MP2:** Species Action Plan **MP4:** Monitoring & Eval System in Place **MP7:** Periodic Review/Update of Mgmt Plan **MP8:** Biodiversity Targets Identified **MR1:** Adequate Staff Training and Skills	**MP5:** Financial Plan in Place **MP6:** Business Plan in Place
GNI per Capita [5]	*No significant correlations of this type were found.*	**LR1:** Legal Contract for Conservation as Goal **MP10:** Status of Surrounding Land Tenure **MR2:** Appropriate Budget for Identified Mgmt Costs **MR4:** Boundary Demarcation	**MP1:** Mgmt Plan in Place **MP2:** Species Action Plan **MP4:** Monitoring & Eval System in Place **MP5:** Financial Plan in Place **MP6:** Business Plan in Place **MP7:** Periodic Review/Update of Mgmt Plan **MP8:** Biodiversity Targets Identified **MP9:** Staffing in Place **MR1:** Adequate Staff Training and Skills	*No significant correlations of this type were found.*
Education Levels: Literacy Rate: Adult Total (percent of people age 15 and above)[6]	**LR2:** Length of Remaining Contract Time	**MR2:** Appropriate Budget for Identified Mgmt Costs	**MP1:** Mgmt Plan in Place **MP2:** Species Action Plan **MP4:** Monitoring & Eval System in Place **MP5:** Financial Plan in Place **MP7:** Periodic Review/Update of Mgmt Plan	*No significant correlations of this type were found.*
Education Levels: Education expenditures: % of GDP as of 2007 [7]	**MP10:** Status of Surrounding Land Tenure	**MR2:** Appropriate Budget for Identified Mgmt Costs **MR4:** Boundary Demarcation	**MP4:** Monitoring & Eval System in Place **MP5:** Financial Plan in Place **MP6:** Business Plan in Place **MP8:** Biodiversity Targets Identified **MP9:** Staffing in Place **MR1:** Adequate Staff Training and Skills	**MP2:** Species Action Plan

[4] (from United Nations Development Programme 2010 data)
[5] (in $ from 2009 World Bank data)
[6] (from World Bank)
[7] (from CIA World Factbook)

EXTERNAL FACTOR	CORRELATION TYPE			
	INCREASING DIRECT	**INCREASING INVERSE**	**DECREASING DIRECT**	**DECREASING INVERSE**
Education Expenditures: Country Comparison to the World [8]	**LR2:** Length of Remaining Contract Time **MR4:** Boundary Demarcation	**MP10:** Status of Surrounding Land Tenure	*No significant correlations of this type were found.*	**MP1:** Mgmt Plan in Place **MP4:** Monitoring & Eval System in Place **MP5:** Financial Plan in Place **MP6:** Business Plan in Place **MP8:** Biodiversity Targets Identified **MP9:** Staffing in Place **MR1:** Adequate Staff Training and Skills
Number of Endemic Species	*No significant correlations of this type were found.*	**MP10:** Status of Surrounding Land Tenure **MR2:** Appropriate Budget for Identified Mgmt Costs **MR4:** Boundary Demarcation	**MP1:** Mgmt Plan in Place **MP2:** Species Action Plan **MP4:** Monitoring & Eval System in Place **MP5:** Financial Plan in Place **MP6:** Business Plan in Place **MP7:** Periodic Review/Update of Mgmt Plan **MP8:** Biodiversity Targets Identified **MP9:** Staffing in Place **MR1:** Adequate Staff Training and Skills	*No significant correlations of this type were found.*
Number of "Higher" Threatened Plant Species [9]	**LR2:** Length of Remaining Contract Time	*No significant correlations of this type were found.*	**MP1:** Mgmt Plan in Place **MP2:** Species Action Plan **MP7:** Periodic Review/Update of Mgmt Plan **MP8:**Biodiversity Targets Identified	**MP6:** Business Plan in Place
Employment in Agriculture [10]	**MR2:** Appropriate Budget for Identified Mgmt Costs	**MR4:** Boundary Demarcation	**MP8:** Biodiversity Targets Identified	**MP5:** Financial Plan in Place **MP7:** Periodic Review/Update of Mgmt Plan

[8] (out of 186 countries from CIA World Factbook)
[9] (from World Bank as of 2008)
[10] (% of total employment from World Bank)

Table VI.4: Comparison of Research Hypotheses to Findings

CODE	MANAGEMENT ATTRIBUTE	Hypothesis	Finding
LR1	Legal Contract in Place	Contracts set official goals for protection with biodiversity conservation. They provide economic incentives and cover the necessary requirements for each specific land area, efficiently conserve biodiversity.	The scores generally increase over time indicating that CI has been successful in implementing legal contracts for conservation of biodiversity at protected sites. There appears to be very few sites with no contract and the great majority of sites have a legal contract in place.
LR2	Length of Remaining Contract Time	Contracts are designed to gain maximum environmental benefits with the given budget and time. Contracts are difficult to adjust in the middle of their duration; indefinitely long contracts are ineffective	The dates of site implementation are practically non-existent for sites receiving a score of 0. The very few that have dates are incredibly recent mostly pertaining to 2007 and 2009. There are too many lose variables to make a concrete conclusion regarding this information.
MP1	Management Plan in Place	To be able to effectively decide which management attributes need to be targeted based on the site's external conditions, a management plan must be in place. A management plan is an important guiding document for a well managed protected area. Review of the management plan allows CI and GCF to examine how the area or areas targeted for sustainable financing and protection will be impacted by the fund mechanism presently and in future.	The distribution of scores is very clear indicating that most sites do not have a management plan in place and very few do. Very slowly, we can also see that over time that sites with management plans has risen. CI has therefore begun to place effort in increasing the number of sites with management plans. We chose our T-distribution test to compare the differences between Scores 0 and 1 (no management plan and management plan that is partially implemented).
MP2	Species Action Plan	Endemic species should be an indicator that more investment should be placed in the planning categories in order to help conserve biodiversity. The areas that should be protected most are not meeting standards.	The distribution of the scores clearly indicates that most sites to not have species action plans in place; however, this has changed significantly over time, from 10% to 32%. The presence of endemic and threatened species in a PA must be known to effectively attempt to conserve these species. The observation is consistent with predictions.
MP3	Education and Awareness Program	The level of education outreach associated with the protected area educates neighboring communities of the importance of the conservation efforts. This also allows for education of visitors and helps in employ locals in the ecotourism industry.	The distribution graph for the change in the management attribute score over three years did not reveal any noticeable trend.
MP4	Monitoring and Evaluation System in Place	Evaluation of the environmental and ecological needs of conservation targets, including both the habitats and ecological processes that support them, as well as identifying threats to their sustainability can be used to assess the compatibility of ongoing or planned activities in these areas.	Evaluation systems were found to have poor scores from the PAME analysis, but are highly correlated with effective conservation. The education and experience of staff could impact a sites ability to problem solve effectively or have the capability to meet the needs/ goals of the site.
MP5	Financial Plan in Place	Financial planning allows long-term oversight through direction, objectives, and budgets. However, the strategies of how conservation planning is approached are just as critical to conservation success as the existence of the plans themselves.	Financial plans are used to organize the distribution of expected funding, but only increased by 2% in 2010. The socio-economic benefits of ecotourism vary from nil to significant, depending on the financial plan in place at the individual PAs. Investment needs to be focused on financial plans in order to effectively improve the strategies and effectiveness of the sites.

CODE	MANAGEMENT ATTRIBUTE	Hypothesis	Finding
MP6	Business Plan in Place	Business plans are created as organizational tools for decision-making and address specific issues such as the potential impacts of threatening processes and socioeconomic circumstances that affect the conservation area planned. Conservation planning may also weigh estimated costs and benefits of various actions.	Over all three years, only one site actually had an approved and implemented business plan. It is difficult to expect these sites to run efficiently without any business plan. These sites are business ventures for organizations like CI and the GCF, and thus should have some manner of a plan.
MP7	Periodic Review/Update of Management Plan	In conservation zones, community based monitoring was highly effective. The outcomes model cited higher behavioral, ecological, and economic success rates in studies where well-established community-level institutions correlated with successful community based monitoring. However, funding largely hinders monitoring.	As a site develops, PAs can benefit from periodic monitoring of the relationship of climate with biodiversity. Currently, more research needs to be conducted to identify which stages of development are most threatening to PAs.
MP8	Biodiversity Targets Identified	Biodiversity has a major impact on the establishment and maintenance of a PA, and should be of upmost importance. Presence of endemic and threatened species in a PA must be known to effectively conserve biodiversity.	Regions with more identified biodiversity targets are in areas where more focus is required. The endemic species external factor showed the same trend across the board: decreasing, direct in all the plan categories. This attribute is one of the most consistently influenced by the external factors.
MP9	Staffing in Place	The most successful outcomes are highly related to well-trained staffs. The success of financial and business plans depends on how they address concerns unique to each PA. This can only come from the placement of a well-trained staff.	There were large inadequacies in staffing and skills in areas of high biodiversity. CI needs to shift focus to these attributes in these countries.
MP10	Status of Surrounding Land Tenure	Conflict over land tenure or land use to be alleviated as education increases due to a convergence of attitudes and knowledge surrounding the existence of protected areas.	Sites where there are no disagreements in the status of land tenure in surrounding communities or the land comprising the site are associated with countries of higher population density. There is also a direct, positive correlation between education levels and the land tenure status, which is consistent with the hypothesized results.
MR1	Adequate Staff Training and Skills	This attribute measures a sites ability to provide adequate staff training and skills. The most successful outcomes are highly related to well-trained staffs.	The education and experience of staff could impact a sites ability to problem solve effectively or have the capability to meet the needs/ goals of the site. The first two scores show a general decreasing trend, showing movement towards higher scores over the three years.
MR2	Appropriate Budget for Identified Management Costs	The sites with a budget able to cover management cost would have more adequate funding and thus an appropriate budget identified for their management costs.	The presence of an appropriate budget for identified management costs shows an unexpected inverse relationship with GNI, HDI, percent of population urbanized, and the number of endemic species.
MR3	Minimum Infrastructure	A key determinant of the success of PAs is whether sites have the minimum required physical and communicational capabilities to handle management needs. Where longer-term commitments are associated with more successful sites and higher levels of sustainable practices.	Did not qualify for a t-test due to random distribution.

CODE	MANAGEMENT ATTRIBUTE	Hypothesis	Finding
MR4	Boundary Demarcation (Limit)	The boundary and surrounding area of a PA are equally important for biodiversity conservation as the PA itself. Heavy reliance on natural resource exports and expanding development puts infringing pressure on conservation lands.	Boundary demarcation increases with a decrease in percentage employment in agriculture, showing a strong negative correlation that's consistent with our hypothesis.
RK1	Biodiversity Research Needs	This attributes assess the sites need for research into biological diversity in order to develop an action plan for species, connected to MP2	This attribute did not have trend in full funding times, no t-test.
RK2	Biodiversity Research Needs - Specific	If the site does NOT need additional biological diversity research, the RK2 attribute asks about the specific nature/field of the ongoing/finished research conducted.	Did not qualify for a t-test due to random distribution.
RK3	Socio-economic Research Needs	This attribute assesses the sites need for research into social economic in order to develop an action plan for species, connected to MP2.	This attribute did not have a t-test due to the lack of numerical data.
RK4	Socio-economic Research Needs – Specific	If the site does NOT need additional social economic research, the RK4 attribute asks about the specific nature/field of the ongoing/finished research conducted.	Did not qualify for a t-test due to random distribution.
LT1	Funding	Funding has a weighty impact upon conservation and PA success. Lack of adequate resources is an unconventional threat in addition to the more traditional threats such as deforestation	This attribute did not have a t-test due to the lack of numerical data.

VII. Discussion

Limitations

There were a number of limitations and concerns when analyzing the statistical results and research. One caveat that needs to be addressed is the statistical reality that running regression tests on many variables inevitably leads to multiple results that show significance simply by chance. In particular, testing at a significance level with a p-value of 5%, as was done in the result analysis, typically yields one false positive result of significance for every twenty correlations performed. Therefore, in order to minimize statistical error, future analyses of the data should be repeated and approached from multiple statistical angles to confirm which correlations are truly significant and not merely due to statistical stochastic uncertainty.

A second limitation arose from the extent to which the external variables could be statistically analyzed with the management attributes. For the external factors involving economic reliance on natural resources, topography, and climate, there were no measurable units to quantitatively run regressions against the management scores but rather qualitative data. However, the lack of quantification does not undermine their important influence upon conservation zone success. When interpreting the data analysis, it is important to remember that these invisible and unaccounted for external factors can act as confounding variables to the results. Especially with regard to the external qualitative factors of climate and topography, which are location-specific, deviations from the expected results in the numerical quantitative analysis may be distorted in a non-quantifiable way. Thus, readers should be wary of the role that such qualitative external factors play when considering the quantitative results presented hereafter. Furthermore, readers should refer to the external research performed in the literature review in order to examine in more detail the state of current knowledge on these factors, as well as for reference and guidance to further reading if desired.

Lastly, limitations arise in the interpretation of results due to uncertainties in causality. Proper communication with CI as well as knowledge of its past strategies must be considered when determining whether causality from our correlation results should be inferred. In other words, the correlations may be a reflection of risks already considered by CI. The term "preventative measures" refers to CI's practice of emphasizing locations with the highest levels

of threat in its conservation efforts. It is unknown whether observed correlations are due to causal influence or merely a reflection of anticipatory and careful planning in PAs. What follows is an attempt to distill and interpret between the two possibilities based upon consideration our results and research.

Major Findings

Many of the external factors showed correlations with at least one or two attributes, but there were a few factors that stood out as having the strongest trends across the various management scores. The number of endemic species, the GNI per capita, and the percent of population urbanized were the three most encompassing, broad-trending influences upon management attributes, followed by education levels as approximated through education expenditures. Sites in areas that have high scores in these factors should be of upmost focus. This is especially true in the attribute areas related to plans, land and boundary issues, and biodiversity targets, since these attributes were the ones most consistently correlated, and thus possibly influenced by the external factors. Essentially, if an attribute is negatively affected or correlated with a particular external factor, areas that have high rankings of that factor should increase their focus on the affected attributes.

Singular Findings

It is interesting to note that boundary demarcation increases with a decrease in the percentage of the population employed in agriculture. Although there was no direct quantitative measurement on exports or resource use, this strong negative correlation provides support for research showing that heavy reliance on natural resource exports and expanding development puts infringing pressure on conservation lands. Research has shown that exports of agricultural produce were found to be linked with deforestation and that agriculture is the number one threat for competing use of land in many developing regions (Hecht 2005). Thus the resulting negative correlation between PA boundary and agricultural employment is in line with our exports and development hypotheses. Yet since the external factor did not show trends across the board and did not show correlations with many other attributes that were expected, additional research is needed. A stronger way of measuring natural resource dependence and development is recommended in order to perform better future analysis on the subject.

Management Plans

The 73 Conservation International PA sites analyzed based on the attribute scorecards had a worrisome recurrence. The vast majority of the sites showed little to no progress in developing any sort of management plan or management plan implementation over the three year period analyzed. For instance, in the distribution of scores of the management plan attribute denoting the status of a business plan (MP6), most of the sites were given a Score 0 over the three years, from 87% in 2008 to 68% in 2010. Score 1 increased from 13% in 2008 to 28% in 2010. However, only the remaining 5% of sites over all three years received Score 2 and 3, representing an approved plan and implemented plan, respectively. In 2009, only one site had a score of 2, meaning the plan was drafted but not implemented. In 2010, two sites had a score of 2, and only one received a score of 3, meaning the plan was actually implemented. Over all three years, only one site actually had an approved and implemented business plan. Most of the scores were 0 and 1, meaning the business plan didn't exist or was being drafted. It is difficult to expect these sites to run efficiently without any business plan. These sites are business ventures for organizations like CI and the GCF, and thus should have some manner of a plan. The fact that such a large number of the sites show little to no progress in developing any sort of management plan or implementation is limiting to our research. To be able to effectively decide which management attributes need to be targeted based on the site's external conditions, a management plan must be in place to organize and recognize the current status and needs of the site. Investment needs to be focused on management plans in order to efficiently improve the strategies and effectiveness of the sites.

Discussion of Major Findings

While going further in depth into the three most prolific external factors (the percent of population urbanized, the GNI per capita, and the endemic species), an examination of other similar factors is critical to speculate the full range of explanations to our results. Although the percent of population urbanized was found to be the factor with the most consistent and widespread trends, the other factors involved with population and growth also had a frequent amount of significant correlations. Yet the correlations involving population density often went against the percent of population urbanized in terms of their directions. The population growth and urbanization growth factors, while also having many correlations, were inconsistent in their

directions and influences. There are a number of possibilities based on outside research and internal speculation to enlighten the results.

Population vs. Urbanization

Our study found that there are opposite results for many of the population density and urbanization density statistics. For instance, biodiversity identified and biodiversity action plan are decrease-inverse for population density, but decrease-direct for urbanization. Decrease or increase refers to whether the attribute score increased or decreased over the 73 sites. Inverse and direct refer to whether or not the correlation between external factor and the attribute change was inversely or directly correlated. Decrease-direct and increase-inverse refer to negative correlations between factors and the attribute, which means, for example, higher external factor scores correlate with lower attribute scores. Therefore, highly urbanized countries have less biodiversity identified, and less urbanized countries have higher scores of biodiversity identified. Yet high population density areas are still able to have high attribute scores for biodiversity identified and action plans in place. The status of surrounding land tenure and boundary demarcation are also opposite for population (increasing, direct) vs. percent urbanized (increasing, inverse). Population density is high yet the scores having to do with surrounding pressures seem to increase. Yet for percent urbanized, the most successful conservation zones in terms of addressing surrounding pressures are in areas with lower urbanization. This supports the predictions that urbanization is a demanding and influential negative factor on conservation zone success. There were also longer legal contracts in areas where Urbanization was lower, giving confidence to the hypotheses that high expansion of urban areas puts pressure on forests to not be locked away as development demands more food and agriculture (Young et al. 2008).

One possible reason for the opposite trends in population density and urbanization percentage is that population density is a great example of the first method that CI tends to use, preventative measures. They place the greatest effort in locations that appear to have the highest levels of threat (strong pressures from population). Perhaps CI should now focus on areas with high urbanization and urbanization growth rates since it not only seems to be a more influential factor but they have obviously not yet established any preventative measures. Urbanization has been shown in many studies to increase deforestation, agriculture, and development in surrounding areas (DeFries et al. 2010). Even the indirect consequences of these activities harm

biodiversity. The roads and infrastructure made to extract the resources and expand development lead to fragmentation. Many studies have made it clear that ecological populations are negatively influenced by changes in fragments and edge effects (Laurance et al .2000). The acquisition and expansion of resources associated with urbanization increases pressure on ecological populations already impacted by the activities themselves.

The trending correlations between urbanization and the attributes, coupled with the fact that the negative trend is not seen in areas with simply a high population density, helps confirm studies claiming that urbanization is a stronger negative influence on conservation efforts than high rural populations, as it demands intensive agriculture and development. The urbanization percentage should be of concern to PA management, since urban areas and their demands have been shown to be much more influential in biodiversity loss and deforestation than rural populations (DeFries et al. 2010). The opposing observations between population density and percent urbanized could either be attributed to Population density in itself not being a primary concern for conservation threat, or a "preventative measure" observation as already mentioned, or a combination of the two. But either way, urbanization percentage has a negative correlation on conservation success that has yet to be addressed, and thus needs to become a focus for PA's that lie in countries with large and growing urban populations**.** The urbanization external factor results could also expose a second possible philosophy: invest in areas that guarantee the most success. Instead of CI using population density as a tool for preventive measures, CI may be using the percent of population urbanized as a way to select sites that guarantee success. For example, the lower the population is urbanized the more success a management attribute has. This is most highly expressed for the management plan and the minimum resources attributes.

The negative results for urbanization percent help support the notion that urbanization is an influential negative factor on conservation zone success, especially in the areas of management and addressing pressures from surrounding land. Sites in urbanizing countries should place their focus on management plans and land issues.

Growth

For the majority of management attributes, especially management plan indictors, higher urbanization growth rates are strongly correlated with better scores. This is similar to the

population density in the way that their increase in extent may be good indicators as to where CI should best place its efforts. The trend in urbanization growth on plan attributes did not go along with predictions, but in retrospect, is not surprising, since the urbanization growth rate is not a reflection on how much pressure there is in a region due to urbanization, but rather a measure of how much there will be in the future. So it is not contradictory that the urbanization growth rates did not negatively correlate with the plan attributes, since the effects of these rates cannot yet be felt. It is more of an indicator of where threats to resources will arise in the future. An exception to this trend for urbanization rates is the tally of how many years are left in a binding legal contract for the conversation site. Urbanization rate is lower in areas that have more than twenty years left on the binding contract, but it is higher at sites that have less than a year remaining. This could mean either one of two things. One possibility is that CI is aware of the impacts of urbanization rates and, believing that lower urbanization rates will guarantee more success, they invested their energy in implementing long-term legal contracts at these sites. Lower urbanization rates correlates to better boundary demarcation, possibly indicating a higher awareness CI has on the negative impacts of urbanization rates. Another alternative, which is in line with previous studies, is that sites with high urbanization growth rates have more pressure on the land from other interests and thus there is more political pressure to have shorter legal contracts so that the land can be potentially developed in the future. Both the attribute and variable are looking towards the future. It would be interesting to further study the effect of development pressures on the length of legal agreement for a conservation zone. Both Urbanization growth and growth rate in general were negatively influencing the status of surrounding land. This goes along with our predictions and previous research that expanding development and support for population growth creates turmoil in land security and puts impinging pressures on the forests. Urbanization and population growth should be a concern in the highest ranked countries since these will soon have high urbanization percentages.

In conclusion, more concern now needs to be placed on areas with high urbanization and urbanization growth in the attributes associated with plans and surrounding land status. Places with dense population have either already been preventively planned for and have well established attributes, there is less impact by rural population, or a combination of both. Either way, the focus should shift to urbanization as a measurement of threat.

Gross National Income (GNI)

Many of the GNI per capita results were counterintuitive to what was predicted, but can be explained by the "preventative measures" hypothesis. Most of the GNI correlations were decreasing and direct, meaning that sites within areas of higher GDP actually had lower management attribute scores. This phenomenon is probably best explained by the fact that CI, in accordance with its "hotspot" approach, has focused much of its resources in the places that it feels are most threatened, as well as where there is the most biodiversity. With respect to GNI per capita, such a focus on resources would occur on countries with lower GNI per capita scores, since such countries are poorer and less developed, and biogeographically speaking, developing countries harbor the most biodiversity while facing the most threat due to inadequate monetary resources to address conservation problems.

Another hypothesis goes back to the idea of the Environmental Kuznets Curve hypothesis, which predicts an inverted-U relationship between environmental degradation and economic development, and has literature supporting it in some aspects (Dasgupta 2002; Dinda 2004). None of the sites analyzed are in countries considered "developed". The higher GNI sites may in fact be in the perfect range that the Kuznets curve peaks, explaining why the countries with the highest GNI also correlated with the lowest attribute scores in many areas. The highest point of the Kuznets curve is typically when countries are "developing". The conservation zones in countries with the higher GNI's may be exposed to greater expansion, an intensification of agriculture, increasing infrastructure (such as increases in roads, which leads to fragmentation and access to more remote areas), and other degrading factors associated with expanding economic growth. More research needs to be put into these speculations in order to assist conservation managers in which stages of development are most threatening to PA's.

Endemic Species

The endemic species external factor showed the same trend across the board: decreasing, direct in all the plan categories. Both endemic species and "higher number plant species" have similar trends, suggesting a stronger confirmation of the correlations found between these and attributes. Areas with more endemic species are in areas with poor scores. The observation is consistent with predictions, since endemic species are located in biodiversity hotspots which are

typically in dense tropical forests in underdeveloped countries. These are more difficult conditions to run conservation zones in, but endemic species should be an indicator that more investment should be placed in the planning categories in order to help conserve biodiversity. The areas that should be protected most are not meeting standards and should focus on the basics of plan establishment. There were also large inadequacies in staffing and skills in areas of high biodiversity. CI needs to shift focus to these attributes in countries with high biodiversity.

The observation of low boundary demarcation in areas with the most biodiversity makes is in line with intuition since biodiversity hotspots occur in denser, more remote forest. The endemic species trends go along with the predictions of high correlations between plan attributes and boundary demarcation and biodiversity. The presence of endemic and threatened species in a PA must be known to effectively attempt to conserve these species. The boundary and surrounding area of a PA are equally important for biodiversity conservation as the PA itself; many species require several adjacent habitats during their entire life-cycle (Jeanneret et al. 2003). All of these habitats must be accounted for when determine the size and boundaries of a PA, suggesting the importance of plans being in place and implemented.

Selected Management Attributes and External Factor Relationships

The following section encompasses a discussion of selected management attributes and external factor relationships. The selected management attributes were chosen because they showed trends that were unexpected and contrary to hypotheses formulated based upon external research, and they therefore deserve further consideration.

Land Tenure

With regard to the external factor of population density, there is a notable increase in higher scores relating to the status of land tenure (MP10) as population density increases; in other words, the external factor of population density and MP10 are directly and positively correlated. In particular, sites with the highest land tenure status score of 3, which represents sites where there are no disagreements in the status of land tenure in surrounding communities or the land comprising the site, are associated with countries of higher population density, such as the Republic of the Philippines, Indonesia, Kiribati, and Costa Rica. While such a correlation is contrary to the hypothesized results of increasing disagreements in the status of land with

increasing population densities due to likely increases in competition for land uses and resources, the results surrounding the aforementioned population density and land tenure relationship may best be understood by viewing them in conjunction with another external factor, the HDI, rather than in isolation (Defries et al. 2010). In particular, it was hypothesized that more developed countries would have a larger proportion of land under "strict protection" with the possibility of higher demand for environmentally quality in a Kuznets-like relationship (McDonald & Boucher 2011). Since HDI is utilized as a proxy for development level, one might expect a direct positive correlation between the external factor of HDI and MP10, and this is exactly what the data supports. Thus, the highest land tenure status score of 3 associated with more developed countries may reflect more developed countries' ability to resolve or absorb conflict surrounding land tenure due to stronger legal systems and capacity to support larger proportions of land under "strict protection." Such a reality may especially explain trends within Costa Rica, which ranked high both in terms of population density and GNI. Hence, it should not be assumed that because the external factor of population density and MP10 are directly and positively correlated that there is less competition for land use and resources because such a reality may be present but overshadowed by the stronger trend of the external factor of HDI upon MP10 and its concomitant implications upon the law and thus "strict" protected areas.

Moreover, with regard to the influence the external factor of education levels as approximated by education expenditures upon MP10, there is a direct, positive correlation between the two, which is consistent with the hypothesized results. Because pro-ecological beliefs, favorable attitudes toward conservation, awareness of protected areas, and higher knowledge of certain legal aspects surrounding conservation are positively correlated with higher levels of education, one might expect conflict over land tenure or land use to be alleviated as education increases due to a convergence of attitudes and knowledge surrounding the existence of protected areas (Keane et al. 2010, Tomićević et al. 2010, Liu et al. 2010). Such an explanation is consistent with existing research and may explain the broad trends observed across all 78 sites.

Appropriate Budget for Identified Management Costs

The management attribute of the presence of an appropriate budget for identified management costs (MR2) shows an unexpected inverse relationship with four main external

factors: GNI per capita, HDI scores, the percent of population urbanized, and the number of endemic species. In other words, despite lower HDI scores, GNI per capita, percentages of populations urbanized, and the number of endemic species, scores for the appropriate budget for identified management costs increased across sites. Concerning the HDI scores and GNI per capita, the results are contrary to what was hypothesized based on external research but consistent with CI's "hotspot" conservation approach. However, with respect to the external factors of the percentages of populations urbanized and the number of endemic species, trends are both contrary to what was expected and reveal a shockingly bothersome funding situation contrary to CI's stated "hotspot" goals.

For instance, with regard to GNI per capita and HDI, it was hypothesized that more developed countries, with GNI per capita and HDI utilized as proxies for development level, would have more adequate funding and thus appropriate budgets identified for their management costs since the main source of PA funding is a country's internal resources, namely its own government budget (Oliviera 2002). In other words, it was hypothesized that there would be a direct, positive correlation between both HDI and GNI per capita and adequate budget across countries. However, statistical analysis reveals the relationship between both HDI and GNI per capita to be inversely related to adequate funding; as HDI and GNI decrease, adequate funding scores instead increase. While such a result seems counterintuitive, it is consistent with CI's "hotspot" approach, whereby sites with the highest amount of species richness with endemism and under the highest amount of threat are identified as priorities. CI is likely aware of the weighty impact that funding plays upon conservation and PA success and may view lack of adequate resources as an unconventional threat in addition to the more traditional threats such as deforestation. Thus, CI is likely focusing its resources upon the areas that lack the monetary resources to create an adequate budget for their PA sites, and lower HDI and GNI scores provide a valuable signal to nonprofit organizations like CI with money to allocate regarding areas where their money is desperately needed to ameliorate funding deficiencies. Funding data would be needed from CI to confirm such behavior. Thus, though seemingly contrary to the trends predicted by the research, the inverse relationship between both GNI an HDI and MR2 are likely be explained by and consistent with CI's "hotspot" approach whereby the most threatened sites are prioritized. See Figure 18.5 and 18.6.

Furthermore, concerning the external factor of the percent of the population urbanized and MR2, there is an inverse relationship between the two variables; there is an increase in scores relating to the appropriateness of budgets identified for management costs with a decrease in the percent of the population that is urbanized. Because the conservation literature shows that urbanization poses a significant threat to biodiversity since the movement of people to cities is related to increased deforestation mainly due to the associated rise in demand for meat, processed food, timber, and other materials from city dwellers, one might expect organizations with limited monetary resources to prioritize such high-threat areas (DeFries et al. 2010). However, the data analysis's revelation of the inverse trend between the external factor of the percent of the population urbanized and MR2 reveals that the allocation process in practice may be contrary to CI's "hotspot" approach which is supposed to prioritize such high-threat areas in its conservation efforts and thus monetary allocation. See Figure 18.3.

Additionally, if considering endemic species is truly a valuable component of CI's "hotspot" approach, the trends shown by the external factor of the number of endemic species with the management attribute of appropriate budget identified for management costs are worrisome, as there is also an inverse relationship between the two. As there is an increase in the scores and thus improvement surrounding appropriate budget for identified management costs, the number of endemic species decreases; put alternatively, the trends show that a site having less endemic species nonetheless has an increase in acquiring appropriate funds. This indicates that funds may not be being distributed in a way consistent with CI's stated strategy. If they were, one might expect to see a positive, direct correlation between the external factor of the number of endemic species and MR2 to indicate that sites with high endemism and at risk of irreversible loss of unique biodiversity were being prioritized in terms of monetary allocation. The fact that the data analysis shows the opposite trend indicates that practices when allocating funds may once again not be in line with CI's theoretical goals. See Figure 18.10.

Recommendations

Based upon the trends observed in the data, CI should follow a series of recommendations in order to be most efficacious in its conservation efforts and stated goals. Firstly, CI should focus its energy on PAs located in areas with high urbanization and high urbanization growth rates since these factors appear to be more influential than population

growth in determining management success and because CI has clearly not established preventative measures in this realm. Additionally, in order to improve the management strategies and effectiveness of sites in conservation, investment needs to be directed toward establishing and maintaining adequate management plans. Furthermore, CI needs to take into account the development levels of the countries in which its PA sites are located and adjust its management strategies to each country's respective needs; in urbanizing countries with developing economies, this means focusing more upon management plans and land issues. Lastly, CI should pay particular attention to PA sites in areas that have high scores in the external factors of GNI, percent of population urbanized, the number of endemic species, and education expenditures since each of these factors significantly affect internal management attributes. Of particular concern to CI should be attribute areas related to plans, land and boundary issues, and biodiversity targets since such internal management attributes were the ones most consistently correlated with the aforementioned external factors and thus most influenced by them.

Key Findings Summary:

-The direct, positive correlation between the external factor of population density and the management attribute of land tenure status (MP10) is contrary to hypothesized results based on research but explainable when viewed in conjunction with another external factor, HDI.

-Positive correlation between MP10 and HDI may provide some support for the Kuznets hypothesis in terms of development attitudinal and legal shifts toward environmentally responsible behavior.

-There is a direct, positive correlation between the external factor of education levels as approximated by education expenditures and MP10, which is consistent with the hypothesized results and extant research.

- The management attribute of the presence of an appropriate budget for identified management costs (MR2) shows an unexpected inverse relationship with four main external factors: GNI per capita, HDI scores, the percent of population urbanized, and the number of endemic species.

-The relationships between both GNI and HDI and MR2 are contrary to what was hypothesized based on external research in but consistent with CI's "hotspot" conservation approach.

- The inverse trend between the external factor of the percent of the population urbanized and MR2 reveals that the allocation process in practice may be contrary to CI's "hotspot" approach.

-The inverse trend between the external factor of the number of endemic species and MR2 indicates that practices when allocating funds may once again not be in line with CI's theoretical goals.

-The number of Endemic Species, the GNI, and the Percent of Population Urbanized were the three most over-encompassing, broad trending influences on management attributes, followed by Education level: Education Expenditures

- The attribute areas relating to plans, land and boundary issues, and biodiversity targets were the attributes were the ones most consistently correlated, and thus possibly influenced by, the external factors.

- Boundary demarcation increases with a decrease in percentage employment in agriculture. This strong negative correlation could confirm how heavy reliance on natural resource exports and expanding development puts infringing pressure on conservation lands.

- The vast majority of the sites showed little to no progress in developing any sort of management plan or management plan implementation over the three year period analyzed.

- Urbanization is a demanding and influential negative factor on conservation zone success.

- For the majority of management attributes, especially management plan indictors, higher urbanization growth rates are strongly correlated with better scores.

-Areas with more endemic species are in areas with poor scores. The observation is consistent with predictions, since endemic species are located in biodiversity hotspots which are typically in dense tropical forests in underdeveloped countries.

Recommendations Summary:

-CI should now focus on areas with high urbanization and urbanization growth rates since it seems to both be a more influential factor than population growth and they have obviously not yet established any preventative measures.

-Investment needs to be focused on management plans in order to efficiently improve the strategies and effectiveness of the sites.

-Sites in areas that have high scores in the external factors of GNI, percent urbanized, endemic species, and education expenditures should be of upmost focus. This is especially true in the attribute areas related to plans, land and boundary issues, and biodiversity targets, since these attributes were the ones most consistently correlated, and thus possibly influenced by the external factors.

-Sites in urbanizing countries should place their focus on management plans and land issues.

VIII. Conclusion

With such a large number of areas around the world that need varying levels of protection, the limited funding must be appropriately distributed to allow for maximum conservation. Through extensive site-level research and statistical analysis, we evaluated CI's management strategies between 2008 and 2010 to draw conclusions about the effectiveness of their past approaches to conservation management and develop a recommended prioritization process.

Our findings, based on a thorough examination of literature concerning best practices for managing protected areas and a detailed statistical analysis of 24 management attributes and 12 external factors, indicate that certain attributes are more affected by external factors. Consequently, we can determine specific management attribute establishment in specific countries based on a country's external factors. Urbanization percentage, urbanization growth rate, number of endemic species and GNI per capita are external factors with overarching trends across the most management attributes. The most successful protected areas will focus on amounts of endemic species, and management attributes must account for high levels of endemism. CI could shift their focus from countries with high population densities to countries with high urbanization percentages and high urbanization growth rates. Funding based on increasing urbanization rates is a preventative method that will increase scores for multiple management attributes before a site faces high threat levels. One other main change that CI could make is implementation of more management plans across all protected areas.

There are infinitely more possibilities to be studied in a similar way, as there are more than twelve external factors influencing protected areas. Qualitative aspects or aid from developed countries may be considered external factors for future research. In addition, all external factors could be statistically analyzed based on threat level categorizations or current deforestation levels, to determine success of management strategies rather than management strategy trends. Our analysis could be reanalyzed alongside the amount of funding provided to each site and to each management attributes. While our limited dataset showed that funds were scarce, we do not know the specific monetary amounts provided in each category. The analysis from this project could be tracked in the future as CI establishes new protected areas to see effectiveness of the transformed management policies.

These changes in management will be beneficial for future protected area establishment. Conservation organizations can create a consistent but adaptable strategy to efficiently manage the allocation of finite investments to specific conservation management techniques. Moving forward, CI should fund management attributes based on the economic, environmental, and cultural characteristics of the country, catering and refining best management practices for each unique protected area.

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X. Appendix

Figure 1: Protected Area Management Effectiveness Framework

Table X.1: The PAME Common Reporting Format Headline Indicators

Element	'Headline indicators' reported in this article
Context	Level of significance
	Extent and severity of threats
	Constraint or support by external political and civil environment
Planning	Protected area gazettal (legal establishment)
	Tenure issues
	Adequacy of protected area legislation and other legal controls
	Marking and security or fencing of park boundaries
	Appropriateness of design
	Management plan
Input	Adequacy of staff numbers
	Adequacy of current funding
	Security/reliability of funding
	Adequacy of infrastructure, equipment and facilities
	Adequacy of relevant and available information for management
Process	Effectiveness of governance and leadership
	Effectiveness of administration including financial management
	Management effectiveness evaluation undertaken
	Adequacy of building and maintenance systems
	Adequacy of staff training
	Staff/other management partners skill level
	Adequacy of human resource policies and procedures
	Adequacy of law enforcement capacity
	Involvement of communities and stakeholders
	Communication program
	Appropriate program of community benefit/assistance
	Visitor management (Visitors catered for and impacts managed appropriately)
	Natural resource and cultural protection activities undertaken
	Research and monitoring of natural/cultural management
	Threat monitoring
Outputs	Achievement of set work program
	Results and outputs produced
Outcomes	Conservation of nominated values—condition
	Effect of park management on local community

Element 'Headline indicators' reported in this article. This framework has become the foundation of many methodologies that directly examine management effectiveness. Source: Leverington, F., Hockings, M., Pavese, H., Lemos-Costa, Lisle, A. 2010. A Global Analysis of Protected Area Management Effectiveness. Environmental Management: 1-14.

Figure 2: Trend Summaries for External Factor and Attribute Correlation

LR1: Legal Contract in Place

This management attribute is a ranking of how much the site is legally gazetted and/or if a goal is in place for a binding contract for protection with biodiversity conservation. The scores generally increase over time indicating that CI has been successful in implementing legal contracts for conservation of biodiversity at protected sites. There appears to be very few sites with no contract and the majority of sites have a legal contract in place.

Urbanization Rate: The rate of urbanization is much higher in sites that have a legal binding contract for conservation and lower in areas that have no contract. CI could possibly be placing more effort in areas where the rates of urbanization are high because they find these locations as more of a threat to the site. Perhaps because a legal contract binding conservation is one of the stronger management attributes that will prevent destruction of the site due to increasing urbanization.

Gross National Income per Capita: Income per capita is much lower in areas with a binding contract for site protection with a focus on biodiversity protection. The income per capita is higher in areas without contracts, which is at first seemingly counterintuitive. Further analysis may indicate that CI invests in making sure legal contracts are in place in places that have lower incomes. This may indicate that CI views areas of lesser income as a greater threat to the success of conservation site protection.

LR2: Length of Remaining Contract Time

LR2 is a ranking of how much time the binding contractual agreement has remaining. Focusing on the distribution of scores it is apparent that sites either have more than 20 years left or less than a year on the contract. Over the three-year period the number of sites with Score 0 decreases while the number of Score 3 sites increases. This could mean that the 1 year left contracts have ended while more sites have been implemented with contracts extending for 20 years or more.

The dates of site implementation are practically non-existent for sites receiving a score of 0. The very few that have dates are incredibly recent mostly pertaining to 2007 and 2009. Sites

that received scores of 3 had implementation dates ranging from 1985 to 2009 with a high concentration in the mid 2000s. There are too many lose variables to make a concrete conclusion regarding this information.

Population Density: The population density is higher in areas where the binding contract for site protection and the conservation of biodiversity has at least another 20 years. Conversely, population density is lower where the contract in place has less than a year remaining. Since most of the score 3 sites were implemented recently, CI may be focusing their efforts for long lasting contracts in areas with high population density.

Population Growth Rate: The growth rate is lower in sites that have contracts with more than 20 years remaining and higher in areas with contracts that have less than a year left. CI may have implemented contracts earlier at sites that have high growth rates. Unfortunately, we do not have data on the growth rates at the time of contract implementation. Furthermore, this could be an area in which CI should focus more of its attention to put long term plans in place where growth rates are high.

Urbanization Rate: The rate of urbanization is lower for sites with contracts in place with more than 20 years remaining and lower for sites with contracts with less than a year remaining. This appears counterintuitive to the goals of CI and this may be an area CI can focus more of its resources.

Number of "Higher" Threatened Plant Species: The number of plant species is much greater at sites that have legal contracts in place for another 20 years or more. CI might be focusing its long-term efforts on threatened plant species that require much time for improvement.

Education Levels: Literacy Rate: Literacy rate is staggeringly high at sites that have legal contracts in place for 20 years or more. CI may deem such sites as ones they can depend upon and therefore expect to enforce an important contract of 20 years or more.

Education Expenditures: Countries that have sites with legal contracts in place for at least another 20 years rank higher on their expenditures on education then the countries with

sites that have a year or less on their legal contract. Again, CI may be investing their long-term goals in places they feel will be able fully enforce their contract.

Human Development Index: The HDI scores of sites with legal contracts in place for at least another 20 years are astronomically high when compared to sites that only have a year or less binding their legal contract for conservation. It appears that CI likes to put in place their long term contracts in places with the highest chance of stability.

MP1: Management Plan in Place

MP1 is a ranking of the extent in which a site has a management plan implemented. The distribution of scores is very clear indicating that most sites do not have a management plan in place and very few do. We can also see that over time that sites with management plans have risen very slowly. CI has therefore begun to place effort in increasing the number of sites with management plans. We chose our T-distribution test to compare the differences between Scores 0 and 1 (no management plan and management plan that is partially implemented).

Number of Endemic Species: The number of endemic species is lower at sites that have a management plan that is partially implemented and higher at sites with no management plan. This may be an indication that CI is not as concerned with endemic species as they are with overall biodiversity protection. CI can focus more of their resources on implementing management plans at sites with a high number of endemic species.

Gross National Income per Capita: GNI per Capita is higher at sites with no management plan. CI may be focusing their attention on sites that have lower GNI per Capita because they view it as more vulnerable.

Education Expenditures: The lower ranking countries do not have management plans in place. CI may be placing their efforts on implementing management plans in places with higher education rankings for they may be more dependable.

Human Development Index: HDI scores are incredibly low at sites that have management plans in place and incredibly high at sites with no management plan. Again, this may be an indication that CI is focusing their attention on sites that need the most protection.

Number of "Higher" Threatened Plant Species: The number of threatened plant species is lower in places with management plans in place that are partially implemented. Conversely, there are many plant species where there is no management plan. CI may not be focusing their efforts on specific plant species and instead focusing them on the overall protection of the site.

Population Growth Rates: The growth rate is relatively very low for sites with no management plan in place. CI may be interpreting higher growth rates as a reason to implement management plans.

Education Levels: Literacy Rate: The literacy rate is lower at sites with management plans in place that are partially implemented and higher for sites with no management plan. CI may interpret lower literacy rates as a threat to the conservation of their site and therefore are implementing more management plans in those areas.

Urbanization Rate: These rates are higher in areas with a management plan in place and partially implemented and lower for sites with no management plan. It is possible again that CI is adjusting its efforts as a precautionary tool.

Overall: There seems to be two ways in which CI might be divvying its resources. The first is by focusing their efforts in areas that might be at higher risk. The other is focusing their efforts in areas they know will be successful. It depends on the management attribute and the external factor at stake.

MP2: Species Action Plan

MP2 uses two scores to determine if there is or is not a species action plan for threatened and restricted-range species articulated in the management plan for the site. The distribution of the scores clearly indicates that most sites to not have species action plans in place; however, this has changed significantly over time. In 2008 only 10% of sites had species action plans but this increased to 32% by 2010.

Gross National Income per Capita: There are no action plans in place where GNI per Capita is higher while there are plans in place with lower GNI per Capita values. This may be another example of CI's precautionary attribution of their resources.

Population Density: The population density is relatively very high at sites with species action plans in place. CI apparently gives great weight to threatened species in their entirety as they make sure to have species action plans in places where there are more people.

Number of Endemic Species: There are lower numbers of endemic species at sites with species action plans in place. This may be an indication that CI does not place as much importance in endemic species.

Percent of Population Urbanized: CI has action plans in place where the population urbanized is lower than in areas with no species action plan. This could be due to the concept that urbanized areas are not as in direct conflict with threatened species that find most contracts with rural societies.

Education Levels: Expenditures: There are species action plans in place in countries that spend a higher percentage of their GDP on education. This could be an example of CI investing in battles they believe they can win for they see countries with more concentration on education as more dependable sites.

Urbanization Rate: Urbanization rates are higher in areas where there are species action plans in place. CI may be trying to protect these species by placing their efforts in areas that have expanding cities.

Number of "Higher" Threatened Plant Species: The number of plant species is lower at sites with a species action plan. This may be another indication that CI uses a more holistic approach to species conservation and does not then just focus on threatened plants.

Population Growth Rate: The growth rates are much higher where species action plans exist. CI may be using their precautionary strategy here to protect species threatened by a growing population.

Education Levels: Literacy Rate: The literacy rate is very low at sites that do have a species action plan and is much higher in places without a plan. This may be another example of CI protecting areas they find to be more at threat. They may view sites within nations with lower literacy rates as places with greater need to protect their threatened species.

Human Development Index: The HDI score is relatively very low in places with species action plan in place and higher where action plans do not exist. Again, CI may deem these sites with low HDI scores as places that put the threatened species at high risk. They therefore focus their resources on making sure species action plans are in place at these locations.

MP3: Education and Awareness Program

This management attribute deals with the level of education outreach associated with the protected area so that neighboring communities are aware of the reasons for and the importance of the conservation efforts. This also allows for education of visitors and helps in employ locals in the ecotourism industry.

The distribution graph for the change in the management attribute score over three years did not reveal any noticeable trend. There was a slight decrease in Score 0 and increase in Score 3 over time, but Scores 1 and 2 were random, thus further analysis of the data correlating with external factors was not investigated.

MP4: Monitoring and Evaluation System in Place

This factor scores the adequacy of the system in place at the site, namely if it monitors the threatened species in an effective manner and if data collection seems sufficient for the area. This probably includes the system of management that is continuously in place by the on-site management as well as the evaluation system that is used when CI steps in and takes data collection and evaluates the day-to-day management effectiveness.

The distribution graph for MP4 revealed Score 0 having greatest frequency each year, yet there was a decrease in Score 0 and increase in Score 3 from 2008 to 2010. Scores 1 and 2 were interesting in the fact that they had similar score frequency in 2008, around 20%. However,

while Score 1 decreased in 2009 and increased in 2010, Score 2 increased and then decreased the next year.

Education Level: Education Expenditures: Countries with a monitoring and evaluation system in place tend to have lower education expenditures as a percentage of the country's GDP. Alternatively, countries that received a lower score, and thus did not have a monitoring and evaluation system in place correlated with those countries that had a greater value for education level: education expenditure.

Education Expenditures: An opposite correlation between this external factor and the education level: education expenditure trend occurs, as countries without a management and evaluation plan in place at their sites tend to spend less money on education, in comparison to the world, than countries that received the highest score and had a sufficient and comprehensive plan in place. Countries with a comprehensive plan actually spent more than twice as much on education expenditures as countries with no plan.

Population Urbanized: Countries that did not have any sort of management and evaluation plan in place at their protected areas showed to have a greater urbanized percent of their population than sites that succeeded in establishing a sufficient plan.

Population Growth Rate: Sites that had a higher score in this management attribute were located in countries that are characterized by a higher population growth rate. These countries with a plan had a rate that was only 0.12% greater than countries with sites that lacked a plan.

Human Development Index: The human development index score for countries that contain sites with no management and evaluation plan in place was only slightly higher, 0.02 points, than the countries' scores for sites that had plans.

Gross National Income per Capita: The GNI correlated with sites that did not have a plan in pace was substantially higher than the country GNI for sites that had a management and evaluation plan.

Education Level: Literacy Rate: When sites did not have a management and evaluation plan in place, their respective country on average had a higher literacy rate than sites that had a comprehensive plan. However, the difference in literacy rate between to two scores was less than 3%.

Number of Endemic Species: Sites with no management plan in place have more than twice the number of endemic species located in that country than sites that actually have an effective management plan.

MP5: Financial Plan in Place

This attribute evaluates whether there is a financial plan in place at the site and if not, if there is one in the works or none at all. The financial plan is aimed to meet the standards set by the GCF; however, it is unknown whether the financial plans are drafted on a completely site-to-site basis or if there is one general plan.

The distribution graph shows an overwhelming majority of ratings at Score 0, thus funding may mot exist at the respective site or it may be mismanaged or use ineffectively due to a lack of financial plan. Over the three years there is a slight decrease in Score 0 and slight increase in Score 1, while Score 2 and 3 remain quite constant in percentage in the high teens.

Percent of Population Urbanized: Countries that did not have any sort of finance plan in place at their protected areas showed to have a greater urbanized percent of their population than sites that succeeded in establishing a sufficient plan.

Human Development Index: The percentage of sites without a financial plan in place decreased by 9% over the three years and the distribution trends showed that it correlated with increase in HDI scores.

Education Levels: Education Expenditures: It is odd that implementing a financial plan negatively correlates with education levels at a site. This might be because the trend over three years in the distribution graph shows that the percentage of approved and implemented financial plan remained relatively consistent. The expenditures on education levels is higher in areas without financial plans, which is at first seemingly counter-intuitive. Further analysis

may indicate that CI invests in making sure legal contracts are in place in places that have lower incomes. This may indicate that CI views areas of lesser income as a greater threat to the success of conservation site protection.

Employment in Agriculture: Sites that implemented a financial plan showed to correlated with almost a 5% increase in the site's employment in agriculture.

Urbanization Rate: A financial plan for a site helps establish core costs of maintaining the reserves and identify marketing strategies, which will make them internally self-sustaining, and the data shows that the placement of a financial plan correlates with an increase in a country's population urbanization.

Population Density: Sites that had a higher score in this management attribute were located in countries that are characterized by a higher population density. These countries with a plan had a rate that was 28% greater than countries with sites that lacked a plan.

Gross National Income per Capita: A financial plan for a site helps establish core costs of maintaining the reserves and identify marketing strategies, which will make them internally self-sustaining, and the data shows that the placement of a financial plan correlates with the site's GNI and population urbanization.

Number of Endemic Species: It is notable that the number of endemic species showed significant decline when correlated with a country implementing an approved financial plan on the distribution graphs. CI might be focusing its long-term efforts on threatened plant species that require much time for improvement.

MP6: Business Plan in Place

Similar to MP5, the status of a business plan in the area is defined to meet the standards of the GCF. This business plan should incorporate all aspects of running and managing the protected area from use of funding, to outreach, to the role of staff.

The vast majority of sites were given a Score 0 over the three years, from 87% in 2008 to 68% in 2010. Score 1 increased from 13% to 28%. Only the remaining 5% of sites over all three years received Score 2 and 3, representing an approved plan and implemented plan,

respectively. In 2009, only 1 had a score of 2, meaning the plan was drafted but not implemented. In 2010, 2 sites have a 2, and only 1 received a score of 3, meaning the plan was actually implemented. Over all three years, only 1 site actually had an approved and implemented business plan.

Gross National Income per Capita: The percent of sites without a business plan in place decreased nineteen percent, while the amount of sites with a business plan in preparation increased fifteen percent between the years 2008 to 2010, sites that had a business plan in preparation correlated with a decrease in the country's GNI.

Education Levels: Education Expenditures: The trend over the three years in the distribution graph shows a correlation with a slight decrease in a site's expenditures on education but vast increase in the site's expenditures relative to the world.

Number of Endemic Species: It is notable that the number of endemic species showed significant decline when correlated with a country preparing a business plan on the distribution graphs, just as it did with a site implementing an approved financial plan.

Percent of Population Urbanized: Although the preparation of a business plan correlated with an increase in population density, it showed 7% decrease in the percent of population urbanized.

Population Density: Sites that had a higher score in this management attribute were located in countries that are characterized by a higher population growth rate. These countries with a plan had a rate that was only 0.2% greater than countries with sites that lacked a plan.

MP7: Periodic Review/Update of Management Plan

This attribute is based on Score 0: There is NO review and Score 1: YES, there is periodic review on the site. This review can be conducted by Conservation International officials or by local management. It would be most effective if all parties involved in understanding and adhering to the management plan were involved in giving their input in amending and improving the plan.

In 2008 and 2009 there was far more Score 1 (79%) than Score 1 (21%), and in 2010, the number of 0 and 1 is almost equal. This is a positive and hopeful trend, as we know the importance of review and updates as new concerns and needs come up over time.

Population Density: Between the three years, the percentage of sites without periodic review or update of plan decreased twenty five percent, with a large decrease in 2010. The increase in the percent of sites with a periodic review of the management plan correlated with an increase in the population densities.

Employment in Agriculture: Sites With Similar Reviews and Updates of Management Plan correlated with a large increase in the percent employment in agriculture.

Number of Endemic Species: Both the implementation of a financial plan and the period reviews of the management plan shows a lack of support for the development of sustainable land and resource use management to reduce the rate of forest degradation and biodiversity loss, because they both correlate with a decrease in the number of endemic species.

Number of Highly Threatened Plant Species: Both the implementation of a financial plan and the period reviews of the management plan shows a lack of support for the development of sustainable land and resource use management to reduce the rate of forest degradation and biodiversity loss, because they both correlate with a decrease in the number of highly threatened plant species. This may be an indication that CI is not as concerned with endemic species as they are with overall biodiversity protection. CI can focus more of their resources on implementing management plans at sites with a high number of endemic species.

Education Levels: Education Expenditures: Sites that had a higher score in this management attribute were located in countries that are characterized by lower expenditures on education. These countries with a plan had a rate that was 206% less than countries with sites that did not have a periodic review or update of a plan.

Human Development Index: The sites with a periodic review of the management plan had distribution trends that it correlated with almost a 4% decrease in HDI scores. The decrease in HDI scores and GNI per capita may be an indication that CI is focusing their attention on sites that need the most protection.

Gross National Income per Capita: The sites with a periodic review of the management plan had distribution trends that it correlated with a significant decrease in the GNI per capita.

MP8: Biodiversity Targets Identified

This attribute is also a Score 0, Score 1 ranking, with 0 representing hat targets not identified and 1representing that targets have been identified.

In 2008, there was more than twice the Score 0 than Score 1, however the chart shows a very clear decrease in Score 0 over the three years with a constant increase in 1 over the years, resulting in more Score 1 than Score 0 in 2010. Thus, this management attribute has been successfully changed.

Population Density: When sites were reported as lacking biodiversity targets, there tended to be a lower population density. Conversely, the sites that had identified biodiversity targets had a slightly higher population density. With a greater population, there may be more awareness for the effects of humans on the environment and greater stress for biodiversity targets.

Percent of Population Urbanized: While there is a greater population density associated with the presence of biodiversity targets, this population tends to be less urbanized than at sites that do not have biodiversity targets. A more urbanized population might be less aware of or less sensitive to conservation efforts and the need for biodiversity targets in hot spots.

Urbanization Rate: Urbanization rate takes on an opposite relationship to the management of biodiversity targets as compared to population urbanized; sites that do not have biodiversity targets are correlated in countries that have a lower urbanization rate. This trend makes sense, since communities that are not yet urbanized are more likely to be in the process of urbanization.

Growth Rate: Sites in which targets are identified have a slightly higher growth rate than sites that do not have targets in place. This is in correlation with the trend of population density. As these sites are growing in population and urbanization they may feel pressure to

determine appropriate biodiversity targets and minimize the human effect on the environment.

HDI Score: A lower human development index score is related to a greater presence of targets. This parallels the relationship of the percent of the population urbanized as urbanization is a factor contributing to the overall HDI score. Less urbanized communities may pay greater attention to the need to define biodiversity targets in conservation efforts.

Gross National Income: Sites with no targets are noted as having almost twice the gross national income per capita as sites containing targets. This adheres to the general trend of more urbanized sites, with greater means of increased income, having a larger impact on nature and less motivation for environmental stewardship.

Education Level: Literacy Rate: A lower literacy rate is correlated with the presence of biodiversity targets. This could be related to the same trend in percent of population urbanized. However, it may be related to CI's management tactic to find the need to step in and implement biodiversity targets since the population at the site is less literate.

Education Expenditures: Higher education expenditures are found in sites that have biodiversity targets. The increased funding may allow these sites to adopt and adhere to biodiversity targets. However, it is concerning that sites that have higher education expenditures still have lower literacy rates. It would be interesting to continue research and observe if these literacy rates increase due to the added educational funding.

Number of Endemic Species: Interestingly, the sites located in countries with no biodiversity targets identified also have higher numbers of endemic species in their countries. This should be a red flag to CI to increase their management involvement in establishing targets to keep the species richness in the area.

Number of Higher Threatened Plant Species: Similar to the previous relationship, the sites that did not yet have biodiversity targets in place were also ones that were located in

countries with great threat to plant species. The growth in population and urbanization could be a contributing factor to habitat destruction and threats to flora and fauna. It is important for CI to identify targets at their sites to prevent these threatened plants from facing extinction.

Employment in Agriculture: There was less employment in agriculture at sites that had biodiversity targets than ones that lacked targets. It is possible that the employment in agriculture is counteractive to conservation and biodiversity protection if the agricultural practices are not sustainable and rather destructive.

MP9: Staffing in Place

For this management attribute Score 0 means that there is inadequate staffing in place whereas 1 means that there is adequate staffing in place. This attribute seems subjective and it would be good to know if that is the opinion of outside evaluation or of the staff and management at the site.

The three-year distribution graph reveals that more sites did not have adequate staffing in place than those that did. The majority of Score 0 occurred in 2008, and in 2009 the Score 0 dropped and Score 1 rose so the two were nearly equal. Then in 2010, Score 1 frequency dropped to back down to slightly above what it was in 2008.

Population Density: This comparison graph shows that sites that did not have adequate staffing in place tended to have a lower population density than the sites that have

Urbanization Rate: Sites that had adequate staffing in place correlated with a higher urbanization rate for their respective country, whereas sites that did not have ample staffing had a lower urbanization rate.

Percent of Population Urbanized: Although the urbanization rate was higher for sites that had sufficient staffing, the actual percent of population urbanized was higher for sites that did not have staffing in place. Therefore, sites that had adequate staffing had about 10% lower urbanized population.

Gross National Income per Capita: Protected area sites that had did not have staffing in place was representative of the respective country's higher GNI per capita, as opposed to lower GNI with sites that have staffing.

Education Level: Education Expenditures: This graph reveals a trend with a higher education level: education expenditure in regards to the percent of the population linked with a higher frequency of Score 0, meaning the site is not adequately staffed. Conversely, a lower expenditure correlates with sites that have staffing in place.

Education Expenditures: In contrast to the previous external factor, the opposite is true for this external factor, education expenditures for the country, as compared to the world. Sites without staffing had a lower education expenditure score, and sites with sufficient staffing correlated with countries that spend more on education.

Number of Endemic Species: More endemic species can be found in countries that lack adequate staffing at the particular protected area site, and sites with appropriate staffing tens to have less endemic species.

MP10: Status of Surrounding Land Tenure

This management attribute deals with the status of the land and the presence of conflict with neighboring communities due to the status of the land (if it is established as a protected area and locals are in argument with the management). Also, the scores address if the conflict is being resolved or not.

The distribution graph shows a trend in large decrease in 0 and slight decrease in 1 with a slight increase in 2 and larger jump in 3 meaning that there are less conflicts and/or these conflicts are being resolved. The majority of the scores are either at Score 0, meaning there are conflicts in the area that are not being resolved, or else they are Score 3 with no conflicts at all.

MR1: Adequate Staff Training and Skills

This attribute measures a sites ability to provide adequate staff training and skills. The education and experience of staff could impact a sites ability to problem solve effectively or have

the capability to meet the needs/ goals of the site. The first two scores show a general decreasing trend, showing movement towards higher scores over the three years.

Percent of Population Urbanized: As more sites over the 3 years receive better staff training resources, the sites tend to reside within less populated countries, making conservation easier (-without the pressures of population, there are more space and focus on conservation?)

Urbanization Rate: Conversely to % pop urbanized, as better staff resources increase, urbanization rates increase. This may be from the fact that CI focuses on developing countries, which are increasing in population rapidly.

Population Growth Rates: Population growth rates increased across scores 0 and 1. Sites with a lower population growth might make staff training more accessible (and without the constraint of resource exhaustion?)

Human Development Index: The decreasing relationship shows how adequate staff skills are being placed within countries that have a lower weighed GDP (which is good, showing how this attribute is benefiting the lower developing countries)

Gross National Income per Capita: The decreasing economic capita is very similar to HDI scores, showing how adequate staff is being made available in the developing countries that need the most help.

Education Levels: Education Expenditures: % of GDP: contrary to OUT of 186, the percentage of money spent on education out of GDP might show how these countries might have other priorities, such as conservation efforts (or corruption)

Education Expenditures: country comparison to the world (Out of 186): When comparing the world, the countries with the highest education expenditures have influenced the resources available for staff training (showing that many countries that value education also value conservation?)

Number of Endemic Species: The most surprising is the decrease in endemic species which is used as an indicator of biodiversity hotspots (from an article produced by CI. This is a huge

problem, because one would think that there would be an increase of endemic species as staff training improves.

MR2: Appropriate budget for identified management costs

This attribute indentifies the sites with a budget able to cover management cost and connects the attribute **MP1: Management Plan in Place**. *The original distribution graph shows an inverse relationship between decrease in score 0 (no operational budget for the site) and increase in score 3 (the available budget covers management costs and permits activities outlined in the management plan).*

Population Density: This is an indicator of good conservation efforts within countries with increasing population density (making conservation lands scarce). This increase in population might have a role in the increase commerce/money available for the budget. Also, due to the involvement of CI, new business might be interested in these countries

Percent of Population Urbanized: Across all comparisons, the sites tend to reside within less populated countries. It would be interesting to know if CI gave more money for budgets, possibly offsetting this problem by economic activity.

Urbanization Rate: The decreasing relationship shows that an increase in a sites appropriate budget for identified management costs is correlated with a decrease in the site's urbanization rate.

Human Development Index: This relationships shows how enough money (budgets) are being placed within countries that have a lower weighed GDP (which is good, showing how this attribute is benefiting the lower developing countries)

Gross National Income per Capita: Is very similar to HDI scores, showing how adequate staff is being made available in the developing countries that need the most help.

Education Levels: Literacy rate %: The average literacy rate decreased over the extreme scores. This shows that the literacy rate of a country does not necessarily dictate the access to budgetary needs.

Education Expenditures: % of GDP as of 2007: The percentage of GDP expenditure decreased across the scores. This shows that the % GDP education expenditure of a country does not necessarily dictate the access to budgetary needs.

Education Expenditures: Country Comparison to the World: The country comparison of education expenditures increased over the scores. This indeed shows a strong relationship between sites that do have the minimum budget needed and education levels. [Significance]

Number of Endemic Species: The number of endemic species decreased across the three scores. In connection to budget, endemic species may not be the only indicator

Number of "Higher" Threatened Plant Species: Sites that had adequate budgets also tended to have higher threatened plant species. When compared to the number of endemic species, the relationship is unclear

Percent Employment in Agriculture: The percentage of sites that had satisfactory budgets, also have higher % employment in agriculture. No matter the job sector, employment is heavily tied to the financial strength a country and those with more monetary strength (jobs) had enough of a budget.

MR3: Minimum Infrastructure

This attribute assesses whether sites have the minimum required physical and communicational capabilities to handle management needs.

MR4: Boundary Demarcation (Limit)

In order to establish and monitor a site, proper land boundaries must be determined. This attribute questions the limit of the boundary known by neighbors and management. The original distribution graph shows an inverse relationship between a decrease in score 0 (boundary of the site is not known by the management authority or local residents / neighboring land users) and increase in score 3 (boundary of the site is known by the management authority and local residents and is appropriately demarcated).

Population Density: Population density increased with the increase of definitive land boundaries. With a higher population density, land boundaries must be systematically (similar to the eastern U.S. vs. .the western U.S.) Without clear boundaries, lawsuits would be commonplace.

Percent of Population Urbanized: In connection boundary limits, the percentage of population urbanized decreased across the scores. Sites with clearer boundaries set between neighbors and authorities tend to lie within lower urbanized settings. (Emphasis on the neighbor interaction due the lower urbanization/ more rural settings?)

Urbanization Rate: Urbanization rates increased as boundary limits became clear to the sites communities. This can be from a host of other external factors, such as an increase in tourism and national attention due CI's intervention.

Population Growth Rates: Overall population growth increased, Countries that grow tend to have better land ownership laws overtime, which may contribute to the increase in boundary demarcations.

Human Development Index: HDI score shows a decrease when sites have clear boundary limits.

Gross National Income per Capita: GNI per capita decreased within sites that made clear boundary demarcations. CI might invest in countries with lower GNI, making boundary limits clearer for legal purposes.

Education Levels: Education Expenditures: Education expenditures percentage of GDP was lower in sites with clearer protection land boundaries. Once again, CI might invest in countries with lower GDP's and education levels because these are the countries with the most opportunity to conserve.

Education Expenditures: Across all scores, the education expenditures in comparison to other countries increased. This may show that although education expenditures is important, a country comparison shows relative education levels, and sites with clearer boundaries are within more educated countries.

Number of Endemic Species: The numbers of endemic species decrease over all scores as sites gained clearer boundaries. It may be easier for sites with lower endemic species to have boundaries/sites than countries with high endemism.

Percent Employment in Agriculture: Percent employment in agriculture decreased across the two scores 0 and 3, showing that sites with clearer boundaries also have lower employment in agriculture (and possibly overall employment). This may show that CI focuses on sites that have lower employment opportunities?

RK1: Biodiversity Research Needs

This attribute assess the sites need for research into biological diversity in order to develop an action plan for species, connected to **MP2: Species Action Plan**.

RK2: Biodiversity Research Needs - Specific

If the site does NOT need additional biological diversity research, the RK2 attribute asks about the specific nature/field of the ongoing/finished research conducted.

RK3: Socio-economic Research Needs

This attribute assess the sites need for research into social economic in order to develop an action plan for species, connected to **MP2: Species Action Plan**.

RK4: Socio-economic Research Needs - Specific

If the site does NOT need additional social economic research, the RK4 attribute asks about the specific nature/field of the ongoing/finished research conducted.

LT1: Funding

LT1 indicates the number of years for which the project has secured 100 percent funding.

Figure 3: T-test tables

Table X.3.1: External Factors and Variance in Site Legal Designations (LR1)

External Factors	**No contract**	**Authority agreed to future protection**	**Contract is being drafted**	**PA has contract**	**T-Distribution**
	Score: 0	*Score: 1*	*Score: 2*	*Score: 3*	*Scores 0 and 3 only*
People per sq. km	36	32	35	40	0.69077927
Population percent urbanized	83%	72%	66%	70%	0.07746536
Urbanization rate	1.1	1.9	2.2	1.7	0.00027411
Growth rate	1.1	1.5	1.6	1.3	0.18318001
HDI score	0.72	0.61	0.57	0.65	0.26006042
GNI per capita	$8408	$5804	$4912	$5493	1.4563E-05
Literacy rate *adult total, % of people age 15 and above*	91%	82%	83%	87%	0.62195746
Education expenditures *% of GDP as of 2007*	5.0%	4.4%	4.4%	4.6%	0.32654954
Education expenditures *country comparison to the world*	67	83	88	90	0.05158421
Number of endemic species	16824	14158	11501	13114	0.23814552
Number of "higher" threatened plant species	334	502	310	382	0.40244833
Employment in agriculture *% of total employment*	17	23	20	20	0.32173994

Table X.3.2: External Factors and Variance in Length of Remaining Contract Time (LR2)

External Factors	**1 Year of Less**	**1 to 10 Years**	**2 to 20 Years**	**More Than 20 Years**	**T-Distribution**
	Score: 0	*Score: 1*	*Score: 2*	*Score: 3*	*Scores 0 and 3 only*
People per sq. km	31	52	27	41	0.00030565
Population percent urbanized	69%	52%	75%	70%	0.49348647
Urbanization rate	0.0%	0.0%	0.0%	0.0%	1.3864E-06
Growth rate	1.6	1.7	1.1	1.2	1.0494E-14
HDI score	0.57	0.57	0.72	0.65	3.3001E-11
GNI per capita	$5659	$3475	$4137	$5564	0.66193708
Literacy rate *adult total, % of people age 15 and above*	83%	70%	89%	88%	7.4992E-10
Education expenditures *% of GDP as of 2007*	4.9%	4.3%	2.4%	4.6%	0.08260918
Education expenditures *country comparison to the world*	70%	97%	161%	88%	4.3634E-09
Number of endemic species	13828	5080	5518	13569	0.63213106
Number of "higher" threatened plant species	322	322	516	391	0.01072379
Employment in agriculture *% of total employment*	21	36	9.1	20	0.20238159

Table X.3.3: External Factors and Variance in Distribution of Staff with Capacity and Resources (GS1)

External Factors	**1 Year of Less**	**1 to 10 Years**	**2 to 20 Years**	**More Than 20 Years**	**T-Distribution**
	Score: 0	*Score: 1*	*Score: 2*	*Score: 3*	*Scores 0 and 3 only*
People per sq. km	30	42	41	42	-
Population percent urbanized	86%	56%	62%	69%	-
Urbanization rate	1.1	2.6	2.1	1.9	-
Growth rate	1.1	1.7	1.4	1.3	-
HDI score	0.70	0.50	0.60	0.69	-
GNI per capita	$8058	$3744	$4069	$4895	-
Literacy rate *adult total, % of people age 15 and above*	90%	78%	84%	89%	-
Education expenditures *% of GDP as of 2007*	5.1%	5.8%	3.8%	3.3%	-
Education expenditures *country comparison to the world*	62	75	108	128	-
Number of endemic species	19353	10060	9936	7877	-
Number of "higher" threatened plant species	367	339	396	369	-

Employment in agriculture *% of total employment*	19	25	20	17	-

Table X.3.4: External Factors and Variance in Reporting to Stakeholders (GS2)

External Factors	**1 Year of Less**	**1 to 10 Years**	**2 to 20 Years**	**More Than 20 Years**	**T-Distribution**
	Score: 0	*Score: 1*	*Score: 2*	*Score: 3*	*Scores 0 and 3 only*
People per sq. km	31	44	42	37	-
Population percent urbanized	85%	53%	57%	71%	-
Urbanization rate	1	3	2	2	-
Growth rate	1	2	2	1	-
HDI score	0.70	0.49	0.56	0.66	-
GNI per capita	$7906	$3461	$4148	$4632	-
Literacy rate *adult total, % of people age 15 and above*	90%	79%	81%	88%	-
Education expenditures *% of GDP as of 2007*	5%	5%	5%	4%	-
Education expenditures *country comparison to the world*	67	80	96	115	-
Number of endemic species	18634	8202	8849	12139	-

Number of "higher" threatened plant species	422	274	458	300	-
Employment in agriculture *% of total employment*	18	21	22	20	-

Table X.3.5: External Factors and Variance in Local Input of Management Decisions (GS3)

External Factors	**Local communities have little/no input**	**Local communities have input, but no direct involvement**	**Local communities directly contribute to decision making**
	Score: 0	*Score: 1*	*Score: 2*
People per sq. km	34	44	37
Population percent urbanized	82%	61%	60%
Urbanization rate	1.3	2.4	2.2
Growth rate	1.2	1.6	1.5
HDI score	0.70	0.57	0.58
GNI per capita	$7237	$4580	$3813
Literacy rate *adult total, % of people age 15 and above*	91%	82%	82%
Education expenditures *% of GDP as of 2007*	5.3%	4.1%	3.7%
Education expenditures	68	98	112

country comparison to the world			
Number of endemic species	18109	10916	7936
Number of "higher" threatened plant species	339	317	446
Employment in agriculture *% of total employment*	18%	26%	18%

Table X.3.6: External Factors and Variance in Contact with Neighbors (GS4)

External Factors	**No contact**	**Regular contact, limited cooperation**	**Regular contact, extensive cooperation**
	Score: 0	*Score: 1*	*Score: 2*
People per sq. km	27	40	46
Population percent urbanized	81%	67%	60%
Urbanization rate	1.3	1.9	2.4
Growth rate	1.2	1.3	1.6
HDI score	0.67	0.63	0.58
GNI per capita	$7379	$5205	$3779
Literacy rate *adult total, % of people age 15 and above*	89%	86%	82%
Education expenditures *% of GDP as of 2007*	5.3%	4.6%	3.6%
Education expenditures	61	91	116

country comparison to the world			
Number of endemic species	17857	13777	7274
Number of "higher" threatened plant species	366	373	378
Employment in agriculture *% of total employment*	18%	22%	20%

Table X.3.7: External Factors and Variance in Site Management Plan in Place (MP1)

External Factors	**No mgmt. plan**	**Mgmt. plan partially implemented**	**Mgmt. plan fully implemented**	**T-Distribution**
	Score: 0	*Score: 1*	*Score: 2*	*Scores 0 and 3 only*
People per sq. km	32	44	60	0.22820552
Population percent urbanized	77%	58%	49%	5.3477E-26
Urbanization rate	1.6	2.3	2.2	5.1447E-18
Growth rate	1.3	1.5	1.1	2.8556E-19
HDI score	0.65	0.57	0.58	3.0772E-22
GNI per capita	$6671	$3513	$2869	3.2861E-13
Literacy rate *adult total, % of people age 15 and above*	87%	83%	79%	1.0871E-30
Education expenditures	4.8%	4.2%	4.7%	0.801047

% of GDP as of 2007				
Education expenditures *country comparison to the world*	76	109	101	0.0212339
Number of endemic species	15873	8206	6445	1.9758E-40
Number of "higher" threatened plant species	394	329	324	1.226E-05
Employment in agriculture *% of total employment*	20%	18%	26%	0.40951522

Table X.3.8: External Factors and Variance in Species Action Plan (MP2)

External Factors	**No species action plan**	**Action plan exists**	**T-Distribution**
	Score: 0	*Score: 1*	*Scores 0 and 3 only*
People per sq. km	33	57	3.28016E-23
Population percent urbanized	73%	54%	8.55342E-33
Urbanization rate	1.8	2.4	3.80283E-15
Growth rate	1.3	1.5	0.001671463
HDI score	0.64	0.56	1.54537E-12
GNI per capita	$5897	$3467	5.84899E-28
Literacy rate *adult total, % of people age 15 and above*	87%	81%	1.45792E-14

Education expenditures *% of GDP as of 2007*	4.4%	5.3%	5.11018E-11
Education expenditures *country comparison to the world*	88	90	0.43140931
Number of endemic species	14360	6461	3.30388E-41
Number of "higher" threatened plant species	393	281	4.67127E-05
Employment in agriculture *% of total employment*	20%	22%	0.051893289

Table X.3.9: External Factors and Variance in Education & Awareness Program (MP 3)

External Factors	**No plan in place**	**Plan in place but not implemented**	**Plan in place but only partially implemented**	**T-Distribution**
	Score: 0	*Score: 1*	*Score: 2*	*Scores 0 and 3 only*
People per sq. km	30.1	31.9	44.6	-
Population percent urbanized	82.8%	76.4%	58.2%	-
Urbanization rate	1.2	1.4	2.4	-
Growth rate	1.2	1.1	1.5	-
HDI score	0.7	0.7	0.5	-
GNI per capita	$7498.8	$6494.2	$3648.8	-
Literacy rate *adult total, % of people age 15 and*	89.6%	89.8%	82.3%	-

above				
Education expenditures *% of GDP as of 2007*	4.8%	4.5%	4.7%	-
Education expenditures *country comparison to the world*	74.6	81.8	93.0	-
Number of endemic species	17392	16369	9700	-
Number of "higher" threatened plant species	537.5	381.4	252.2	-
Employment in agriculture *% of total employment*	17.2%	19.4%	21.0%	-

Table X.3.10: External Factors and Variance in Monitoring & Evaluation System in Place (MP 4)

External Factors	**No program in place on site**	**Insufficient program for site**	**Sufficient program for site**	**Sufficient and comprehensive program and systematically used**	**T-Distribution**
	Score: 0	*Score: 1*	*Score: 2*	*Score: 3*	*Scores 0 and 3 only*
People per sq. km	33.0	40.4	43.9	31.2	0.586033816
Population percent urbanized	84.1%	60.4%	57.1%	69.9%	4.11E-25
Urbanization rate	1.1	2.0	2.7	1.8	2.76022E-41
Growth rate	1.1	1.4	1.7	1.2	3.35833E-05
HDI score	0.7	0.6	0.5	0.7	9.3351E-10
GNI per capita	$7885.8	$4530.0	$3354.9	$4363.5	4.80393E-50

Literacy rate *adult total, % of people age 15 and above*	90.4%	82.4%	81.3%	87.7%	8.44278E-25
Education expenditures *% of GDP as of 2007*	5.1%	4.9%	3.9%	3.3%	2.01644E-55
Education expenditures *country comparison to the world*	63.1	95.6	106.0	130.8	2.85073E-56
Number of endemic species	18719.8	10901.6	8515.6	8500.9	1.72063E-44
Number of "higher" threatened plant species	356.8	562.7	277.9	382.8	0.067971846
Employment in agriculture *% of total employment*	18.9%	23.4%	20.2%	18.2%	0.255201259

Table X.3.11: External Factors and Variance in Financial Plan in Place (MP5)

External Factors	**No financial plan for site**	**Financial plan prepared, not yet approved**	**Approved financial plan but not yet implemented**	**Approved and implemented financial plan**	**T-Distribution**
	Score: 0	*Score: 1*	*Score: 2*	*Score: 3*	*Scores 0 and 3 only*
People per sq. km	28.3	48.4	47.4	55.7	3.17593E-20
Population percent urbanized	73.2%	59.6%	71.2%	60.2%	2.3548E-11
Urbanization rate	1.8	2.2	1.8	1.7	0.20199765
Growth rate	1.4	1.5	1.2	1.1	1.29359E-10
HDI score	0.6	0.6	0.7	0.6	0.039745739
GNI per capita	$6249.8	$4553.5	$4798.8	$3327.8	1.56835E-22

Literacy rate *adult total, % of people age 15 and above*	85.1%	83.6%	91.0%	82.9%	0.015640294
Education expenditures *% of GDP as of 2007*	5.1%	4.6%	3.8%	3.5	1.06786E-44
Education expenditures *country comparison to the world*	64.5	109.3	109.9	125.9	8.46413E-54
Number of endemic species	15451.1	8476.8	12173.8	6402.7	7.81143E-33
Number of "higher" threatened plant species	324.1	699.7	299.5	296.2	0.173111091
Employment in agriculture *% of total employment*	19.8%	20.3%	18.0%	24.5%	8.28116E-07

Table X.3.12: External Factors and Variance in Business Plan in Place (MP6)

External Factors	**No business plan**	**Business plan in preparation**	**Approved plan but not yet implemented**	**Approved and implemented plan in place**	**T-Distribution**
	Score: 0	*Score: 1*	*Score: 2*	*Score: 3*	*Scores 0 and 3 only*
People per sq. km	35.0	37.4	118.0	303.0	0.187425706
Population percent urbanized	71.1%	64.1%	57.0%	49.0%	1.53208E-06
Urbanization rate	1.8	2.0	2.6	2.3	0.035396089
Growth rate	1.4	1.3	1.9	2.0	0.055585449
HDI score	0.6	0.6	0.5	0.6	0.018205399
GNI per capita	$5785.2	$4300.6	$3416.7	$2050.0	2.14759E-12

Literacy rate *adult total, % of people age 15 and above*	85.7%	85.8%	83.7%	94.0%	0.922746288
Education expenditures *% of GDP as of 2007*	4.9%	3.6%	3.9%	2.6%	1.06381E-15
Education expenditures *country comparison to the world*	76.6	124.5	110.5	162.0	3.68765E-41
Number of endemic species	14113.8	8578.4	9575.7	6649.0	4.34366E-23
Number of "higher" threatened plant species	348.1	476.1	221.0	216.0	2.94776E-06
Employment in agriculture *% of total employment*	20.2%	19.1%	27.7%	36.1%	0.258286793

Table X.3.13: External Factors and Variance in Periodic Review/Update of Management Plan (MP7)

External Factors	**No periodic review or update of plan**	**Periodic review and update of plan in place**	**T-Distribution**
	Score: 0	*Score: 1*	*Scores 0 and 3 only*
People per sq. km	34.4	45.4	5.93283E-06
Population percent urbanized	74.1%	58.4%	2.03284E-25
Urbanization rate	1.7	2.2	8.61747E-08
Growth rate	1.4	1.3	0.240372609

HDI score	0.6	0.6	2.2029E-06
GNI per capita	$6114.2	$3801.4	1.48059E-26
Literacy rate *adult total, % of people age 15 and above*	86.3%	84.2%	0.003332677
Education expenditures *% of GDP as of 2007*	4.5%	4.7%	0.167350546
Education expenditures *country comparison to the world*	86.7	92.4	0.071956625
Number of endemic species	14098.2	9954.5	1.43148E-14
Number of "higher" threatened plant species	424.7	247.9	2.10974E-10
Employment in agriculture *% of total employment*	19.4%	21.8%	0.009638402

Table X.3.14: External Factors and Variance in Biodiversity Targets Identified (MP8)

External Factors	**Biodiversity targets not identified**	**Biodiversity targets identified**	**T-Distribution**
	Score: 0	*Score: 1*	*Scores 0 and 3 only*
People per sq. km	34.8	41.0	0.010412156
Population percent urbanized	74.6%	62.6%	5.75355E-16
Urbanization rate	1.6	2.3	6.69362E-17
Growth rate	1.3	1.4	0.000210858
HDI score	0.6	0.6	1.71404E-06
GNI per capita	$6584.4	$3958.2	3.11543E-33
Literacy rate *adult total, % of people age 15 and above*	86.1%	85.1%	0.161256101

Education expenditures *% of GDP as of 2007*	4.9%	4.0%	3.66396E-10
Education expenditures *country comparison to the world*	73.8	109.5	6.26337E-26
Number of endemic species	15663.7	9334.3	2.23302E-30
Number of "higher" threatened plant species	433.8	299.1	1.10161E-06
Employment in agriculture *% of total employment*	21.1%	18.6%	0.006265885

Table X.3.15: External Factors and Variance in Staffing in Place (MP9)

External Factors	**Inadequate staffing at site**	**Adequate staffing for site needs**	**T-Distribution**
	Score: 0	*Score: 1*	*Scores 0 and 3 only*
People per sq. km	34.5	42.1	0.001753173
Population percent urbanized	73.1%	63.5%	3.94546E-11
Urbanization rate	1.7	2.1	6.07876E-05
Growth rate	1.4	1.3	0.13152229
HDI score	0.6	0.6	0.722839362
GNI per capita	$6230.1	$4136.0	1.04935E-22
Literacy rate *adult total, % of people age 15 and above*	86.0%	85.1%	0.221745737
Education expenditures *% of GDP as of 2007*	5.1%	3.6%	4.67304E-22
Education expenditures *country comparison to the world*	70.4	115.5	1.45182E-38
Number of endemic species	14869.6	9808.4	1.10716E-20

Number of "higher" threatened plant species	384.9	356.9	0.301636275
Employment in agriculture *% of total employment*	19.5%	20.9%	0.133413689

Table X.3.16: External Factors and Variance in Status of Land Tenure in Surrounding Communities (MP10)

External Factors	**Disagreement of land tenure status in site and surrounding area**	**Disagreements in land tenure status for surrounding area but not on site**	**Disagreements are being resolved, but in-site conflicts exist**	**No disagreements in status in and surrounding site**	**T-Distribution**
	Score: 0	*Score: 1*	*Score: 2*	*Score: 3*	*Scores 0 and 3 only*
People per sq. km	27.2	34.3	42.9	47.9	2.92246E-17
Population percent urbanized	74.0%	65.0%	73.4%	65.9%	1.92737E-06
Urbanization rate	1.9	2.4	1.5	1.7	0.035610901
Growth rate	1.5	1.7	1.1	1.2	1.09113E-09
HDI score	0.6	0.5	0.7	0.7	8.37E-09
GNI per capita	$6115.3	$4435.8	$5898.0	$5113.0	1.9749E-05
Literacy rate *adult total, % of people age 15 and above*	84.9%	80.1%	90.3%	88.4%	6.60048E-06
Education expenditures	4.8%	4.4%	4.5%	4.5%	0.09234241

% of GDP as of 2007					7
Education expenditures *country comparison to the world*	72.7	87.4	88.8	101.0	4.96774E-13
Number of endemic species	15103.3	10973.2	14406.4	11169.4	1.36237E-10
Number of "higher" threatened plant species	422.0	280.8	306.4	393.4	0.43319333
Employment in agriculture *% of total employment*	19.0%	21.2%	20.3%	20.5%	0.170175527

Table X.3.17: External Factors and Adequate Staff Training and Skills (MR1)

External Factors	**Staff training and skills are inadequate...**	**Staff training and skills are adequate, no continued training**	**Staff training and skills are adequate, ongoing training**	**T-Distribution**
	Score: 0	*Score: 1*	*Score: 2*	*Scores 0 and 2 only*
People per sq. km	38	34	41	0.22220048
Population percent urbanized	77	67	59	0.00000000

Urbanization rate	1.4	2.2	2.3	0.00000000
Growth rate	1.2	1.5	1.4	0.00000000
HDI score	0.66	0.6	0.6	0.03520061
GNI per capita	6791	4607	3965	0.00000000
Literacy rate *adult total, % of people age 15 and above*	87	86	83	0.09297009
Education expenditures *% of GDP as of 2007*	5.4	4	3.4	0.00000000
Education expenditures *country comparison to the world*	64	104	120	0.00000000
Number of endemic species	16572	12414	6984	0.00000000
Number of "higher" threatened plant species	332	305	518	0.09178975
Employment in agriculture *% of total employment*	21	20	18	0.08707338

Table X.3.18: External Factors and Appropriate Budget for Identified Management Costs (MR2)

External Factors	**There is no operational budget for the site**	**The available budget is inadequate**	**The available budget covers management costs, but does not permit other activities**	**The available budget covers management costs and permits other activities**	**T-Distribution**

	Score: 0	*Score: 1*	*Score: 2*	*Score: 3*	*Scores 0 and 3 only*
People per sq. km	26	40	43	53	0.00000000
Population percent urbanized	86	70	58	50	0.00000000
Urbanization rate	1.1	1.7	2.7	1.8	0.00000000
Growth rate	1.1	1.3	1.7	1.2	0.08720568
HDI score	0.70	0.65	0.54	0.59	0.00000000
GNI per capita	8071	5330	3479	3545	0.00000000
Literacy rate *adult total, % of people age 15 and above*	90	87	83	75	0.00000000
Education expenditures *% of GDP as of 2007*	5.2	4.8	3.6	4	0.00000000
Education expenditures *country comparison to the world*	61	96	113	102	0.00000000
Number of endemic species	19337	11661	8946	8086	0.00000000
Number of "higher" threatened plant species	366	371	364	457	0.00000151
Employment in	19	18	20	32	0.00000000

agriculture *% of total employment*					

Table X.3.19: External Factors and Minimum Infrastructure (MR3)

External Factors	**There is no infrastructure at the site**	**There is inadequate infrastructure to support management activities**	**Infrastructure is adequate for basic management needs, but not maintained**	**Infrastructure is adequate and maintained as needed**
	Score: 0	*Score: 1*	*Score: 2*	*Score: 3*
People per sq. km	27	47	47	49
Population percent urbanized	80	55	62	65
Urbanization rate	1.5	2.6	2.3	1.8
Growth rate	1.2	1.7	1.6	1.1
HDI score	0.66	0.52	0.58	0.68
GNI per capita	6937	3539	4128	4448
Literacy rate *adult total, % of people age 15 and above*	88	80	81	90
Education expenditures *% of GDP as of 2007*	4.9	5.2	3.9	3.5
Education expenditures	71	95	106	117

country comparison to the world				
Number of endemic species	16032	8613	12284	9945
Number of "higher" threatened plant species	338	328	306	576
Employment in agriculture *% of total employment*	17	21	34	17

Table X.3.20: External Factors and Boundary Demarcation (MR4)

External Factors	**The boundary of the site is not known by the management authority**	**The boundary of the site is not know by local residents / neighboring land users**	**The boundary of the site is known but is not appropriately demarcated**	**The boundary of the site is known and is appropriately demarcated**	**T-Distribution**
	Score: 0	*Score: 1*	*Score: 2*	*Score: 3*	*Scores 0 and 3 only*
People per sq. km	25	28	42	45	0.00000000
Population percent urbanized	86	78	61	66	0.00000000
Urbanization rate	1.1	1.6	2.3	1.9	0.00000000
Growth rate	1.1	1.4	1.5	1.2	0.01846825

HDI score	0.70	0.64	0.57	0.66	0.00000010
GNI per capita	8104	6958	4283	4484	0.00000000
Literacy rate *adult total, % of people age 15 and above*	90	87	82	90	0.17722696
Education expenditures *% of GDP as of 2007*	5	5	4	4	0.00000771
Education expenditures *country comparison to the world*	60	62	102	105	0.00000000
Number of endemic species	19845	16512	10082	10334	0.00000000
Number of "higher" threatened plant species	374	320	369	413	0.23877017
Employment in agriculture *% of total employment*	19	18	24	16	0.00026763

Table X.3.21: External Factors and Biodiversity Research Needs (RK 1)

External Factors	**Additional biodiversity information is required to develop an action plan for species**	**Additional biodiversity information is NOT required to develop an action plan for species**
	Score: 0	*Score: 1*
People per sq. km	38	37
Population percent urbanized	70	68
Urbanization rate	1.9	1.9
Growth rate	1.4	1.3
HDI score	0.61	0.67
GNI per capita	5630	4591
Literacy rate *adult total, % of people age 15 and above*	85	87
Education expenditures *% of GDP as of 2007*	4.9	3.3
Education expenditures *country comparison to the world*	78	127
Number of endemic species	14048	7909
Number of "higher" threatened plant species	337	516
Employment in agriculture *% of total employment*	21%	16%

Table X.3.22: External Factors and Socio-Economic Research Needs (RK3)

External Factors	**Additional socio-economic information is required to develop an action plan for site**	**Additional socio-economic information is NOT required to develop an action plan for site**
	Score: 0	*Score: 1*
People per sq. km	33	46
Population percent urbanized	69	70
Urbanization rate	1.9	1.7
Growth rate	1.5	1.2
HDI score	0.59	0.67
GNI per capita	5598	5145
Literacy rate *adult total, % of people age 15 and above*	84	89
Education expenditures *% of GDP as of 2007*	5	4
Education expenditures *country comparison to the world*	74	107
Number of endemic species	13927	11071
Number of "higher" threatened plant species	361	392
Employment in agriculture *% of total employment*	22	17

Figure 4: Table Of Contents

Attribute	Figure Number	Title
	18.7	Appropriate Budget for Identified Management Costs and Education Levels: Literacy rate (%)
	18.8	Appropriate Budget for Identified Management Costs and Education Expenditures: Percentage of GDP as of 2007
	18.9	Appropriate Budget for Identified Management Costs and Education Expenditures: Country Comparison to the World
	18.10	Appropriate Budget for Identified Management Costs and Number of Endemic Species
	18.11	Appropriate Budget for Identified Management Costs and Number of "Higher" Threatened Plant Species
	18.12	Appropriate Budget for Identified Management Costs and Percent Employment in Agriculture
MR4	19.1	Boundary Demarcation
	19.2	Boundary Demarcation and Population Density
	19.3	Boundary Demarcation and Percentage of Population Urbanized
	19.4	Boundary Demarcation and Urbanization Rate
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	19.6	Boundary Demarcation and HDI scores
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	19.9	Boundary Demarcation and Education Expenditures: Country Comparison to the World
	19.10	Boundary Demarcation and Number of Endemic Species
	19.11	Boundary Demarcation and Percentage Employment in Agriculture

Figure 5: Distribution Graphs

Figure 1.1 Legal Contract for Conservation

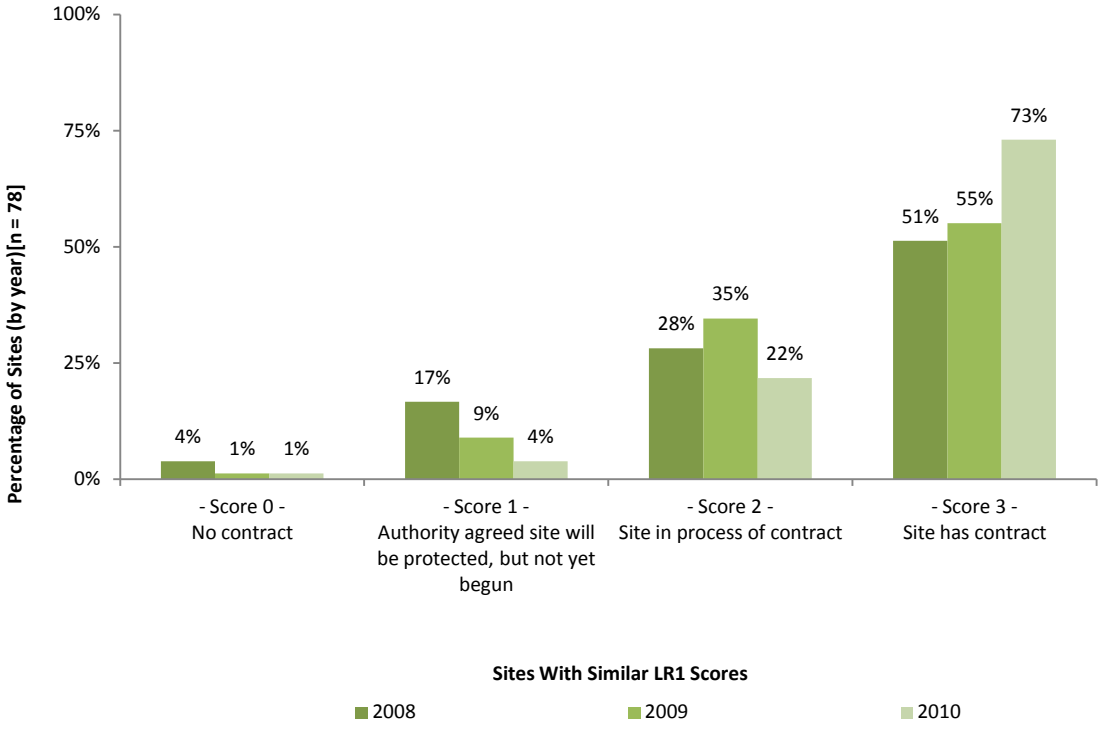


Figure 1.2 Legal Contract for Conservation and Urbanization Rate

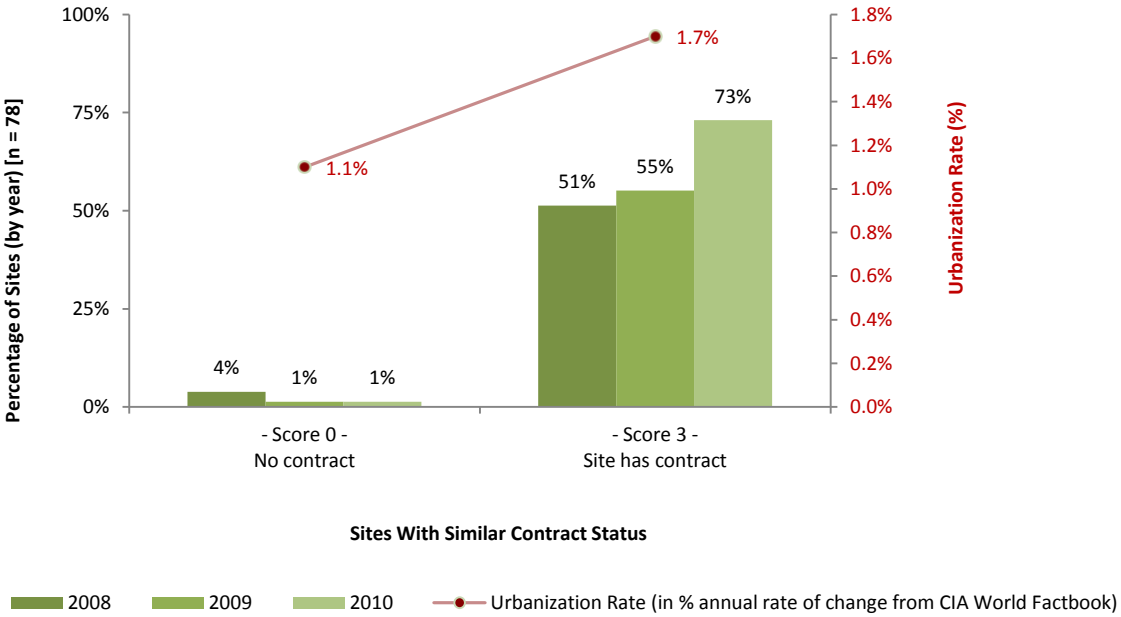


Figure 1.3 Legal Contract for Conservation and GNI per Capita

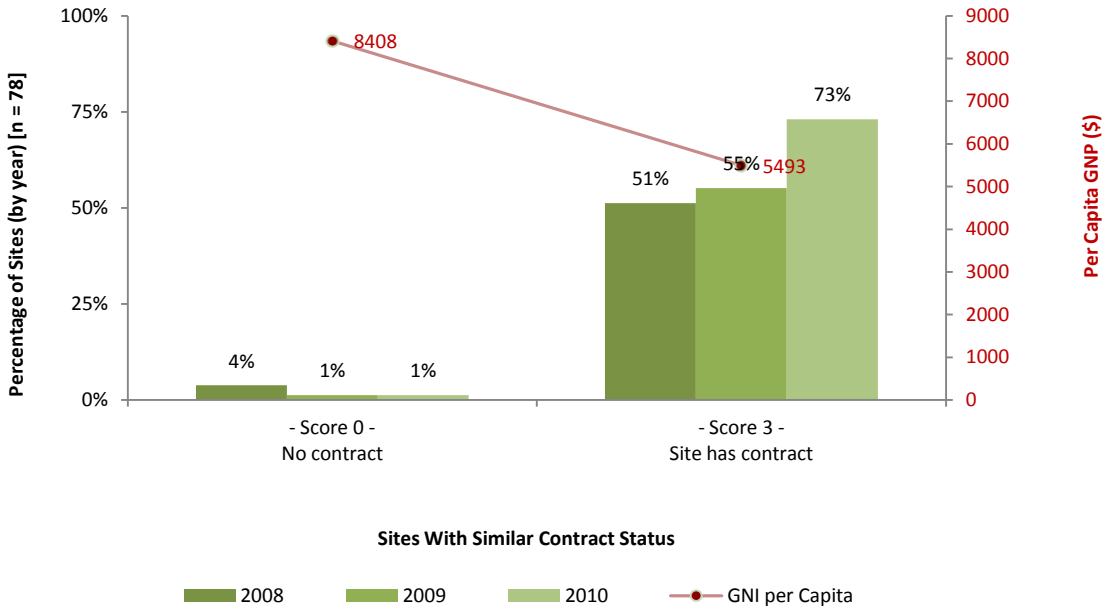


Figure 2.1 Length of Remaining Contract Time

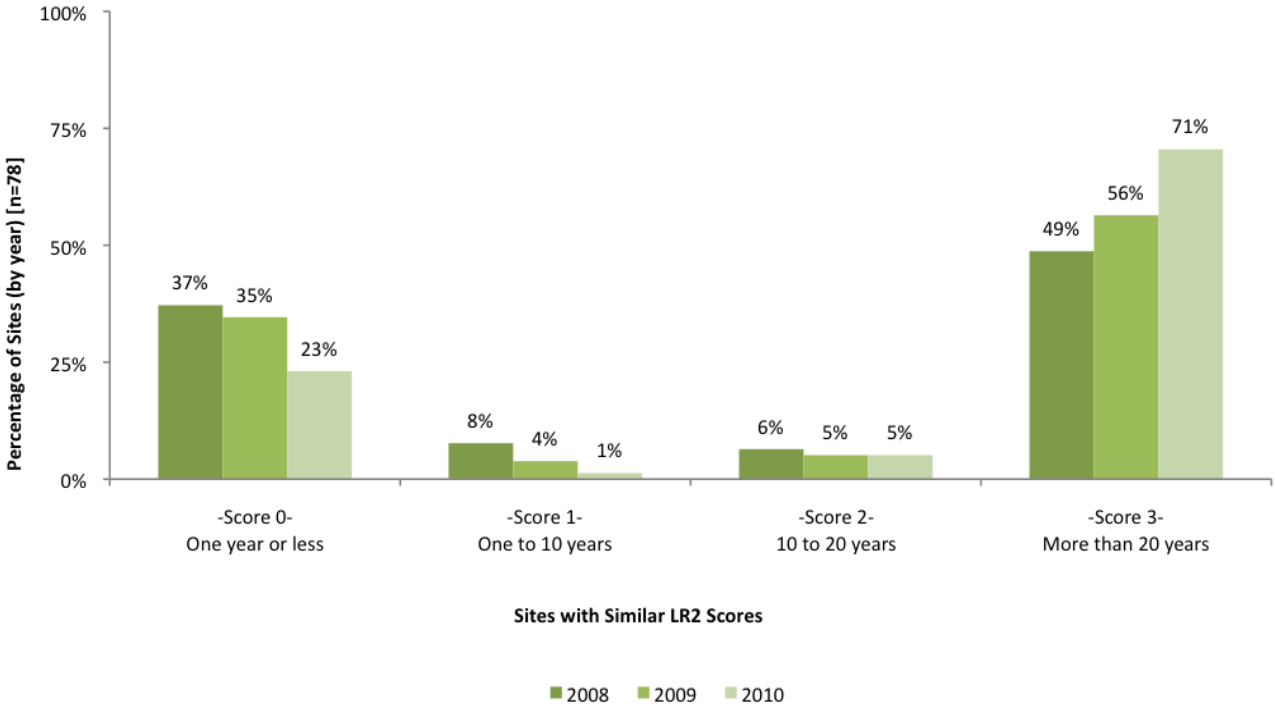


Figure 2.2 Length of Remaining Contract Time and Urbanization Rate

Figure 2.3 Length of Remaining Contract Time and Population Density

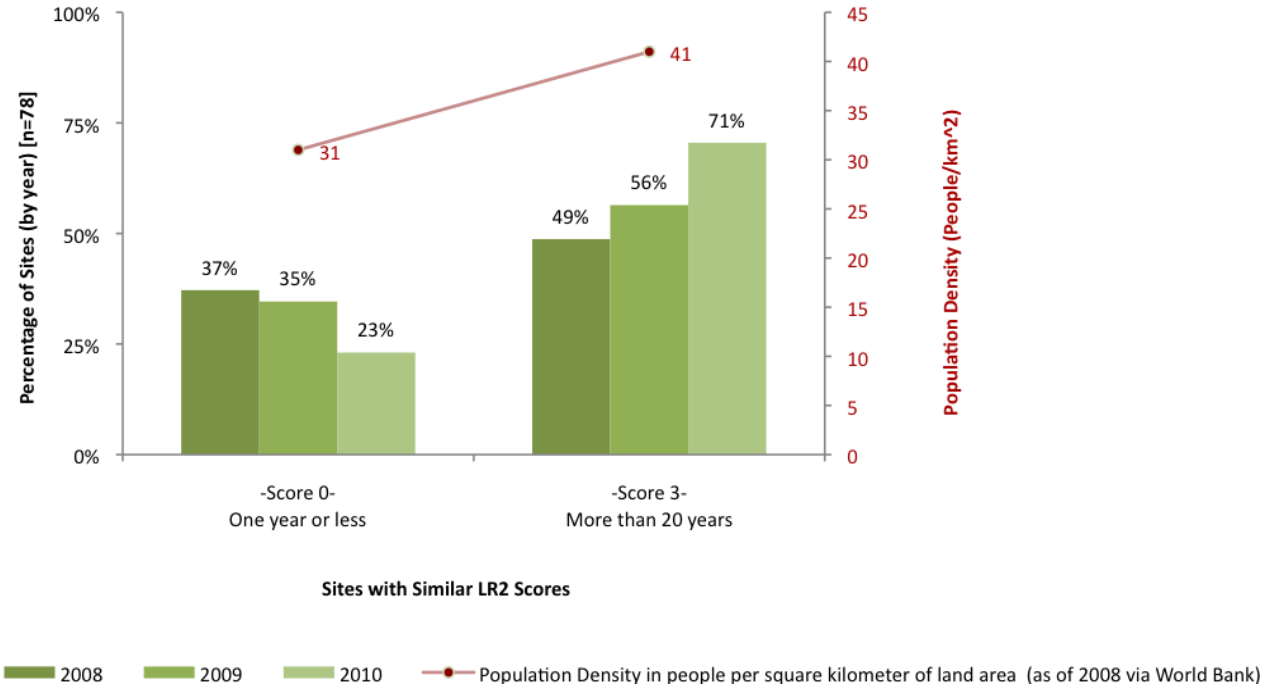


Figure 2.4 Length of Remaining Contract Time and Education Levels: Literacy Rate

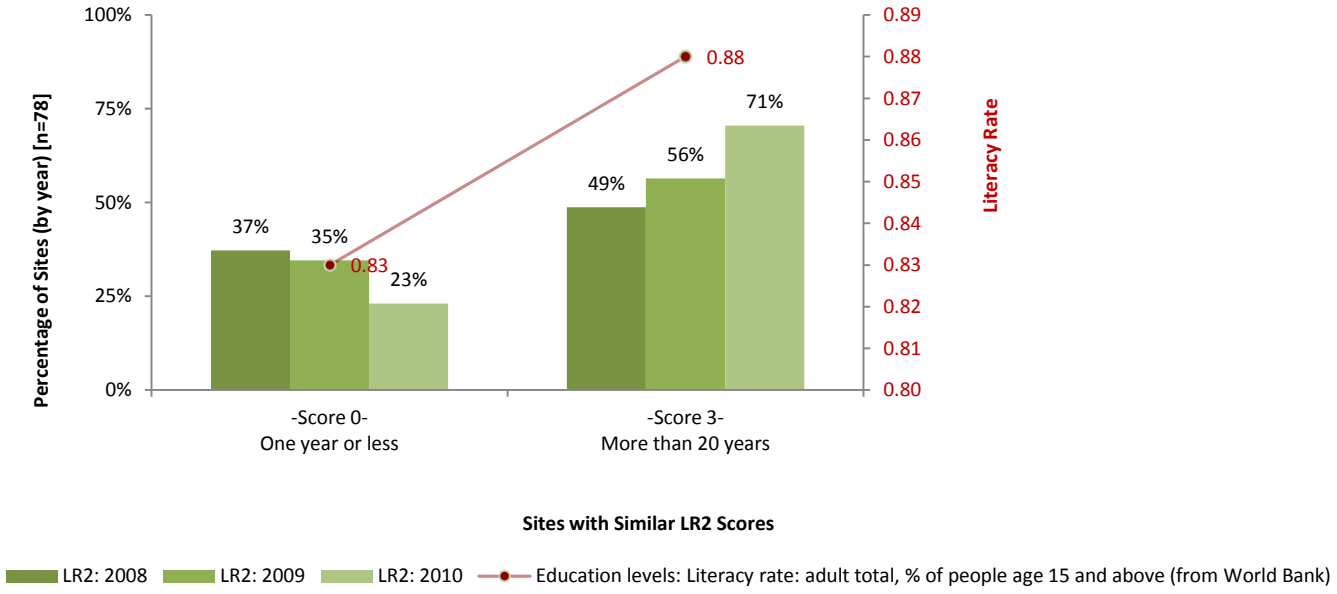


Figure 2.5 Length of Remaining Contract Time and HDI Score

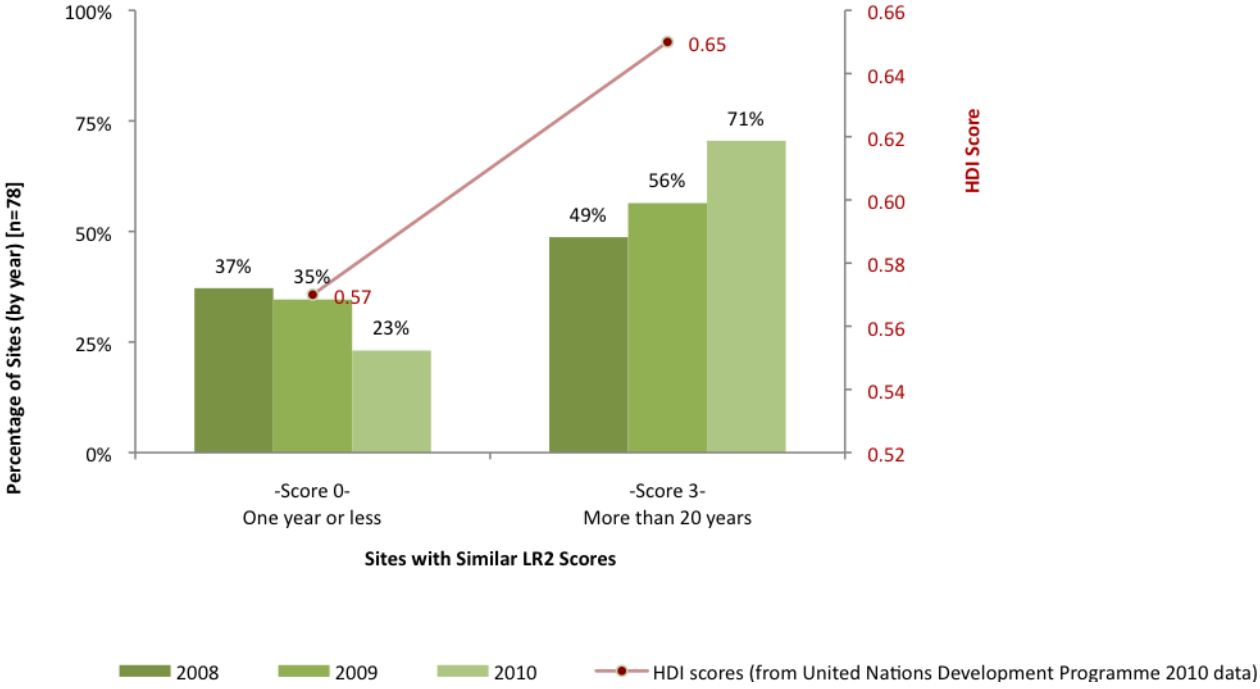


Figure 2.6 Length of Remaining Contract Time and Growth Rate

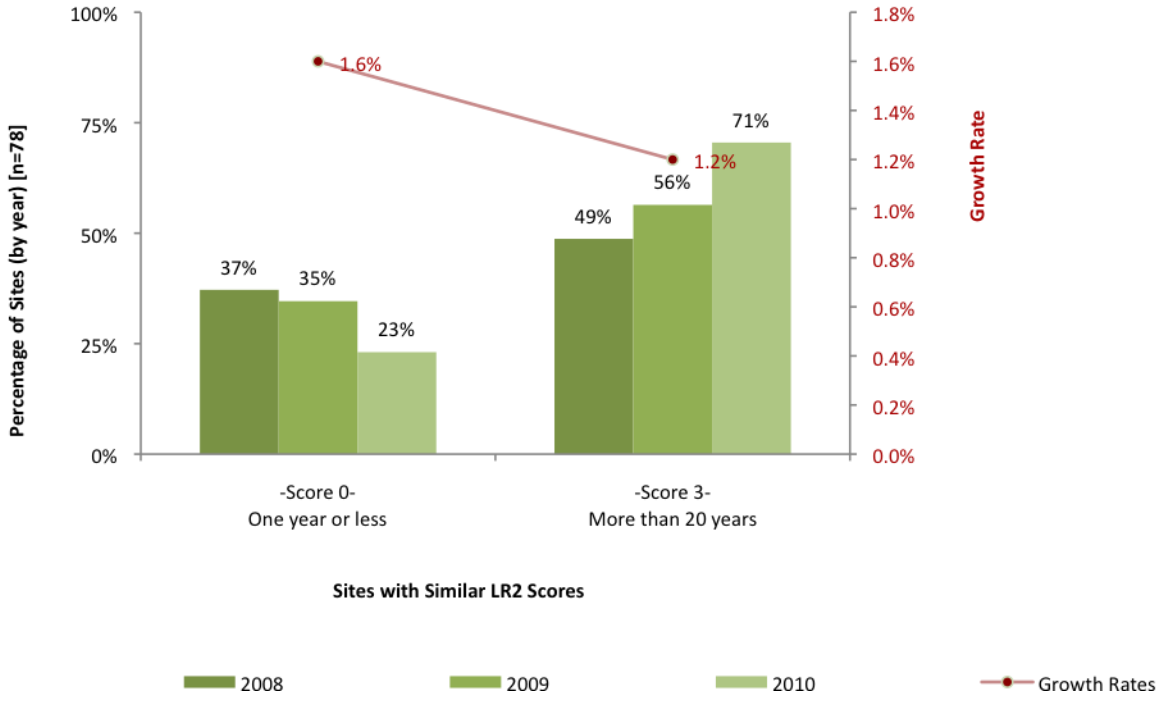


Figure 2.7 Length of Remaining Contract and Number of "Higher" Threatened Plant Species

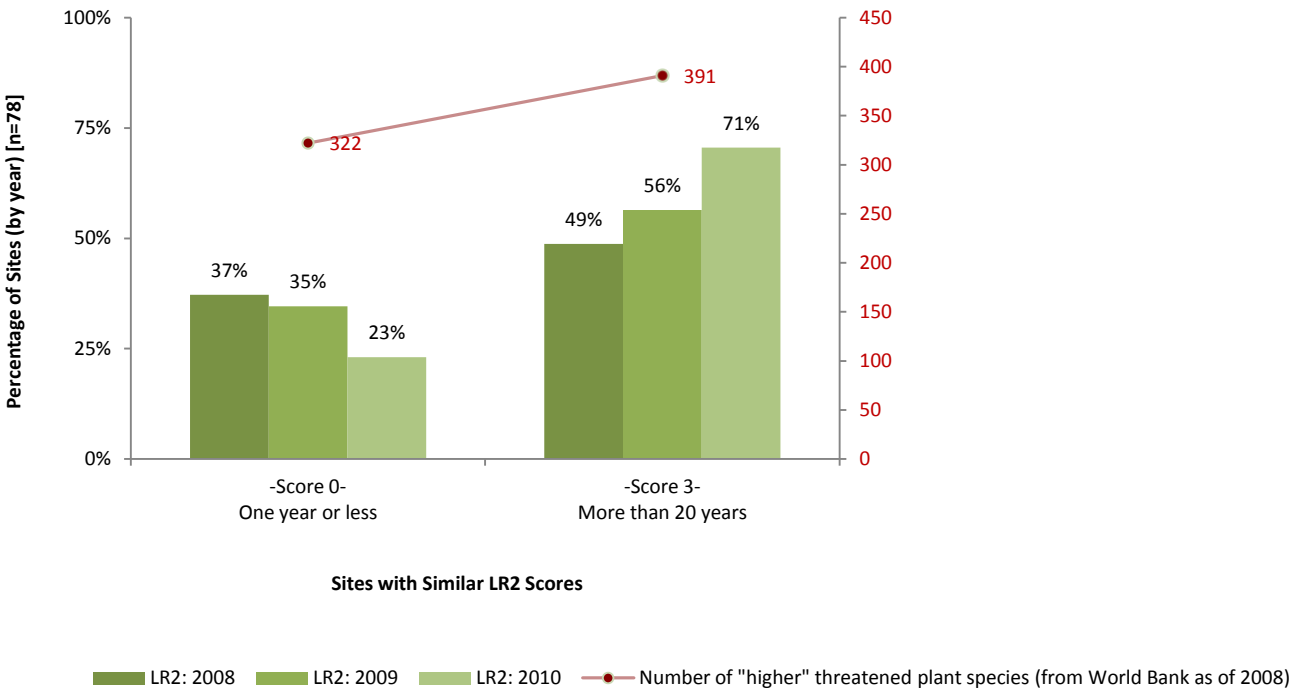


Figure 2.8 Length of Remaining Contract Time and Education Expenditure Country Rank

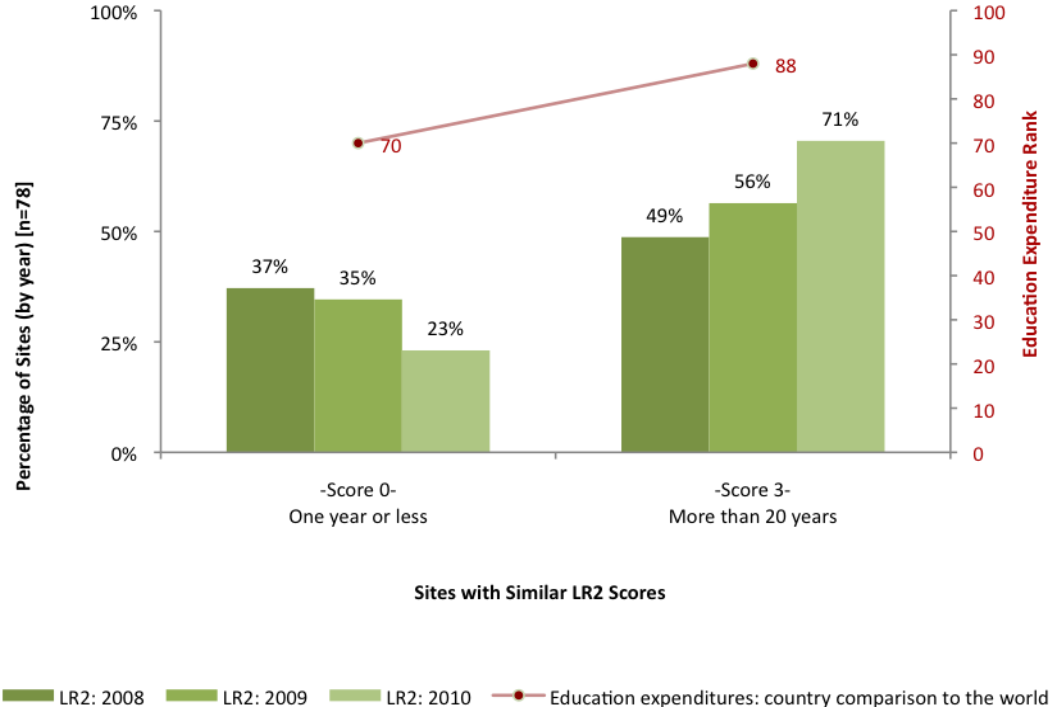


Figure 3.1 Distribution of Staff with Capacity and Resources

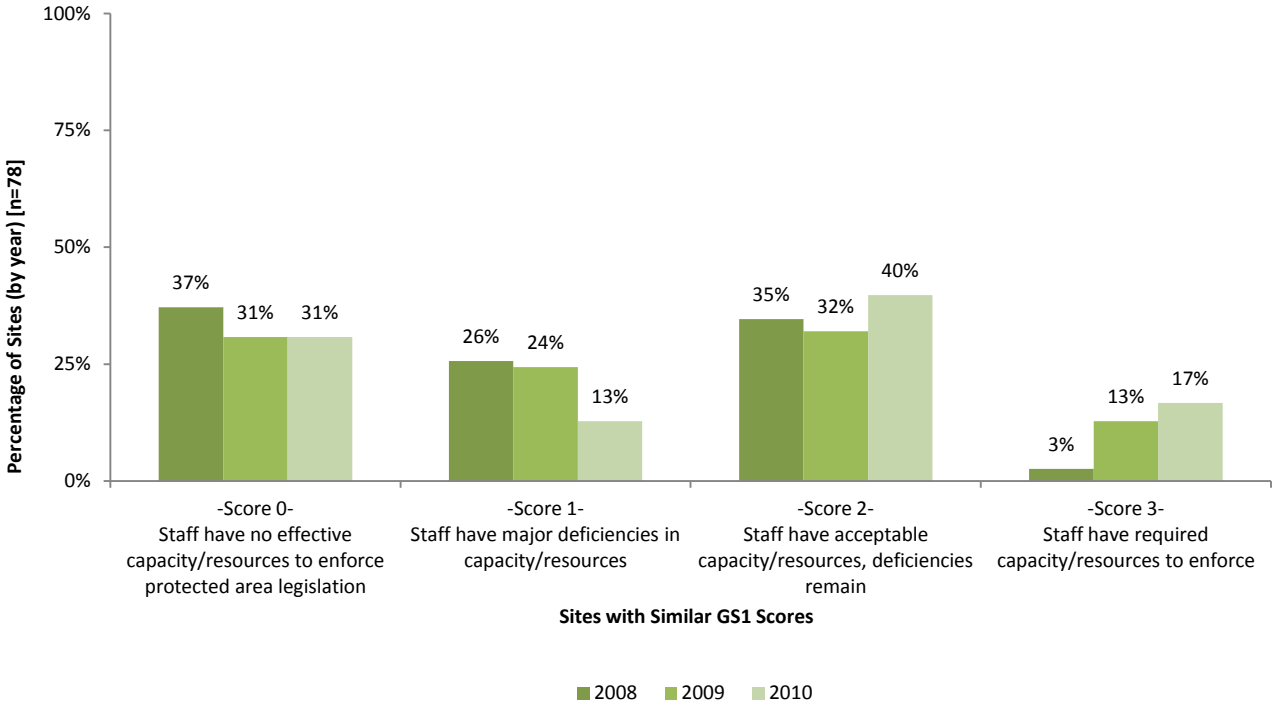


Figure 4.1 Distribution Reporting to Stakeholders

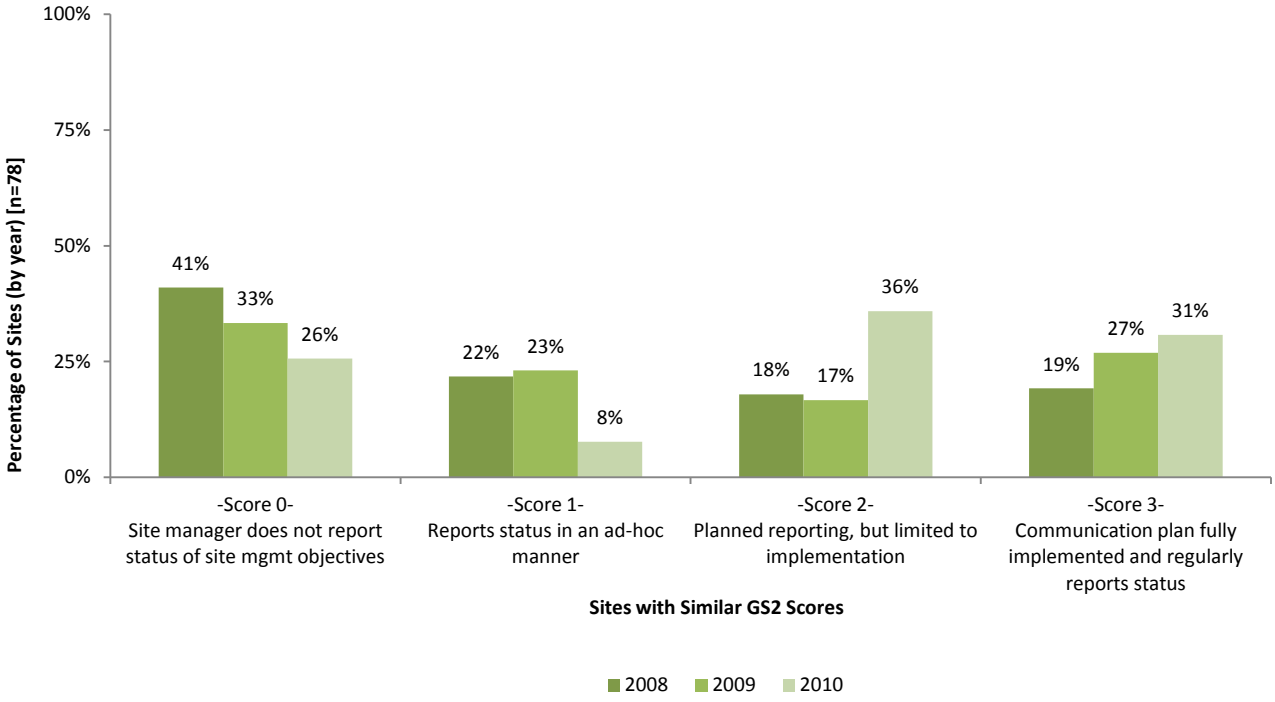


Figure 5.1 Distribution of Local Input of Mgmt Decisions Across 78 sites Over 3 Years

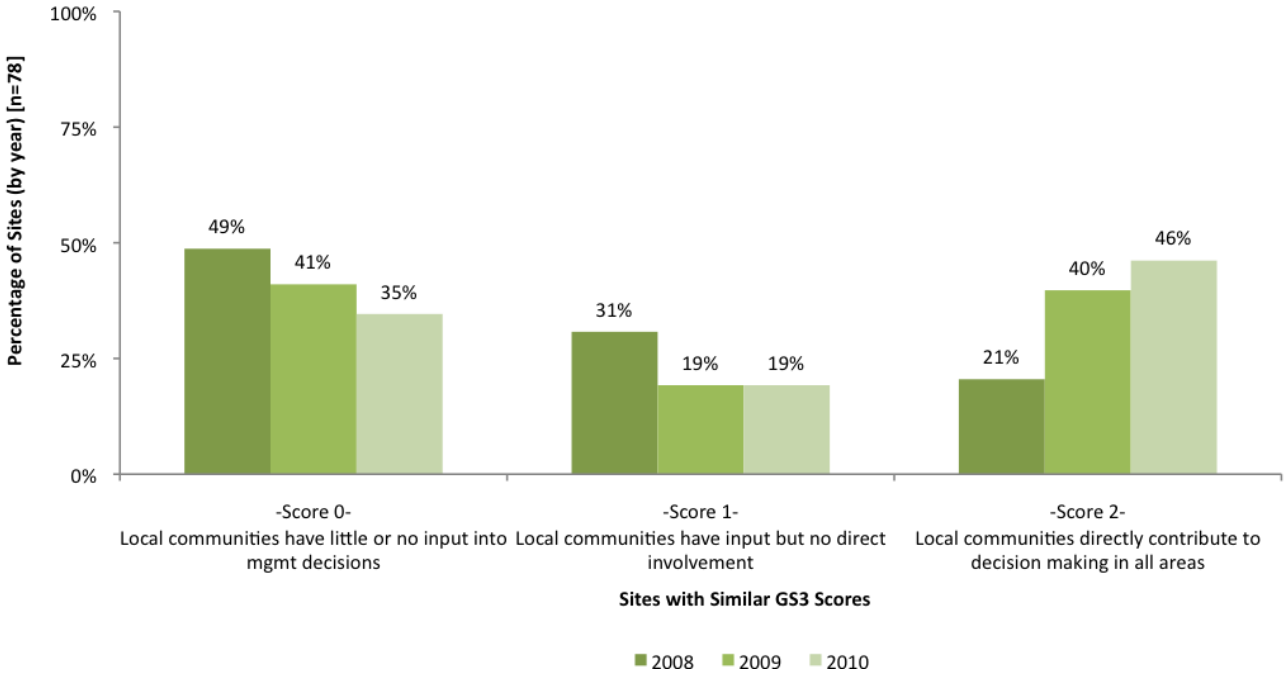


Figure 6.1 Distribution of Contact with Neighbors

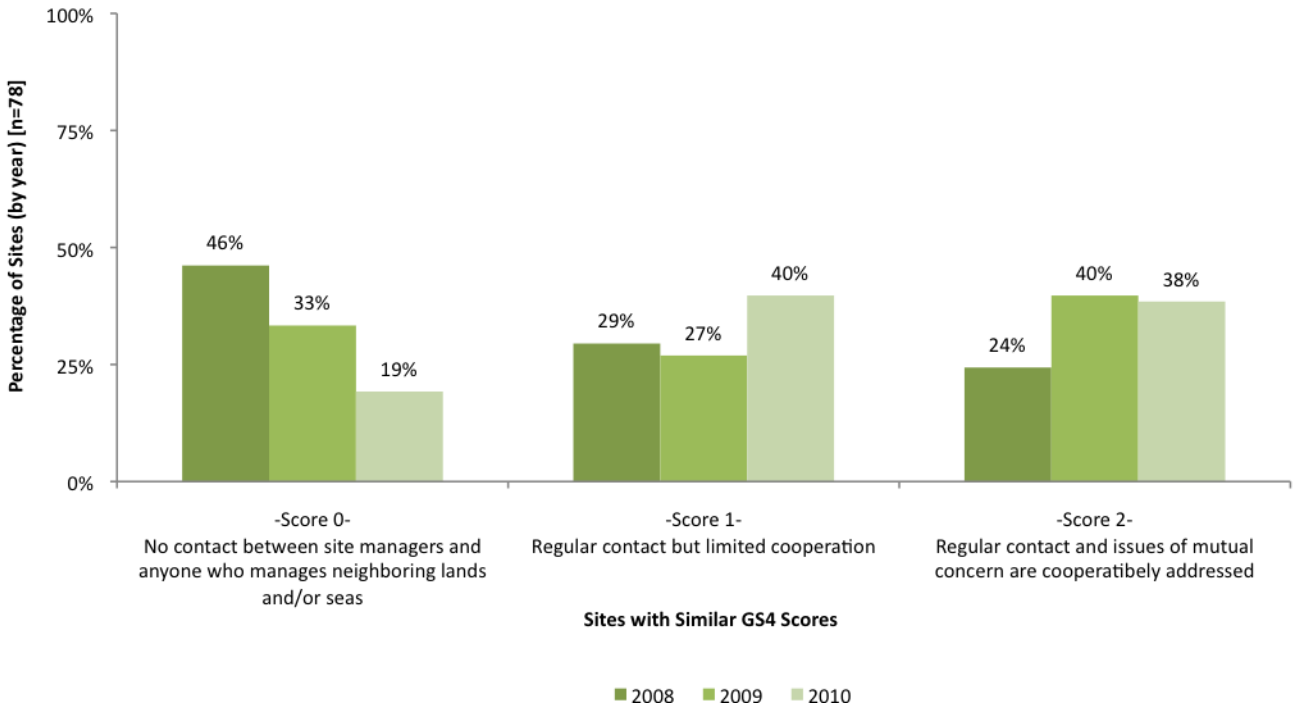


Figure 7.1 Management Plan in Place

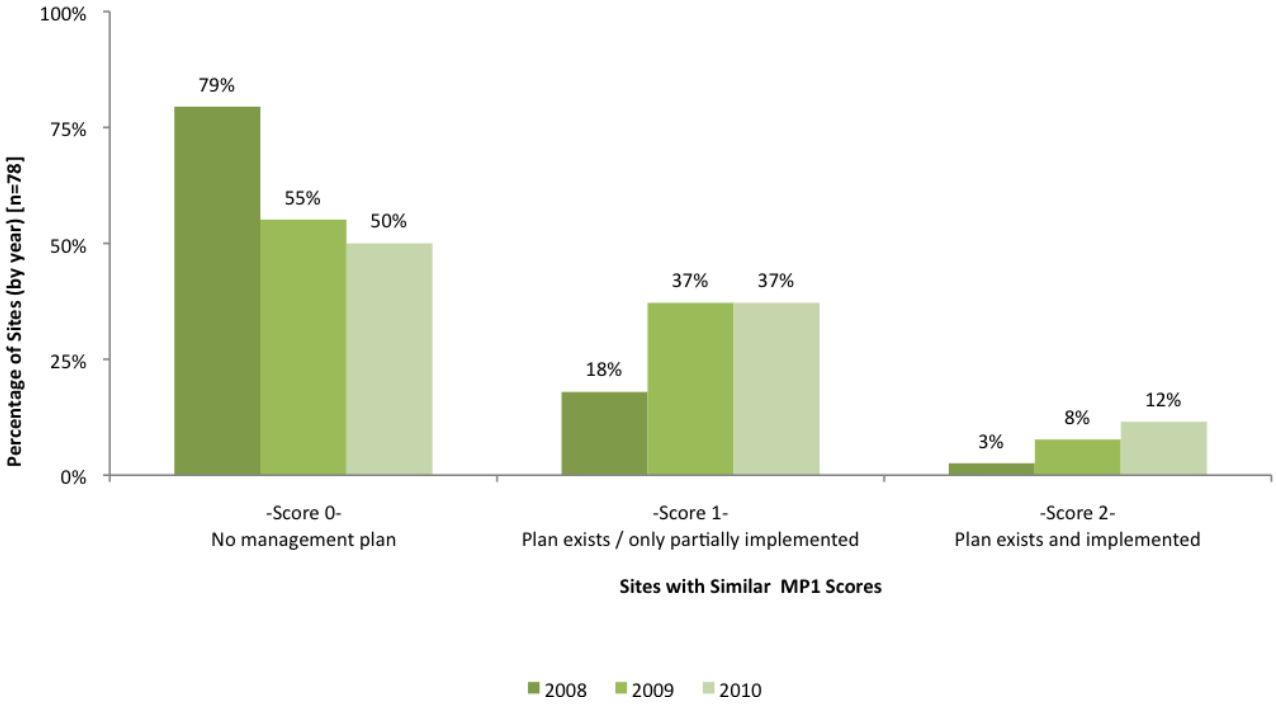


Figure 7.2 Management Plan and Number of Endemic Species

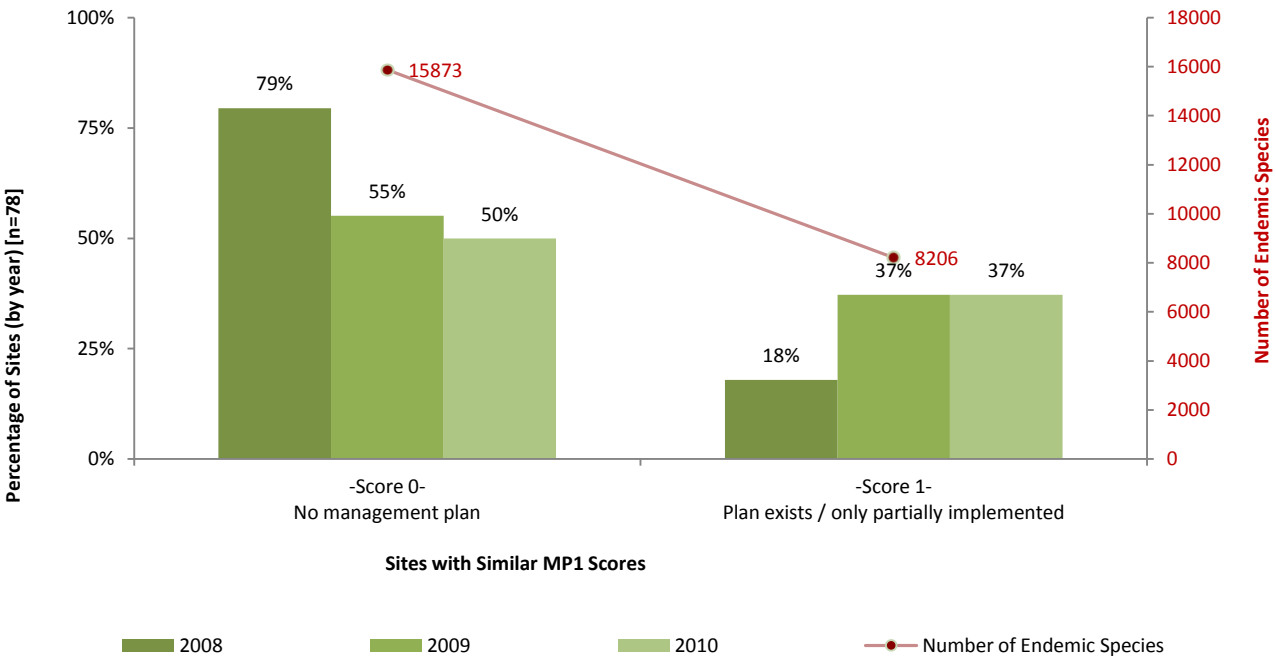


Figure 7.3 Management Plan and Education Expenditure Country Rank

Figure 7.4 Management Plan and Number of "Higher" Threatened Plant Species

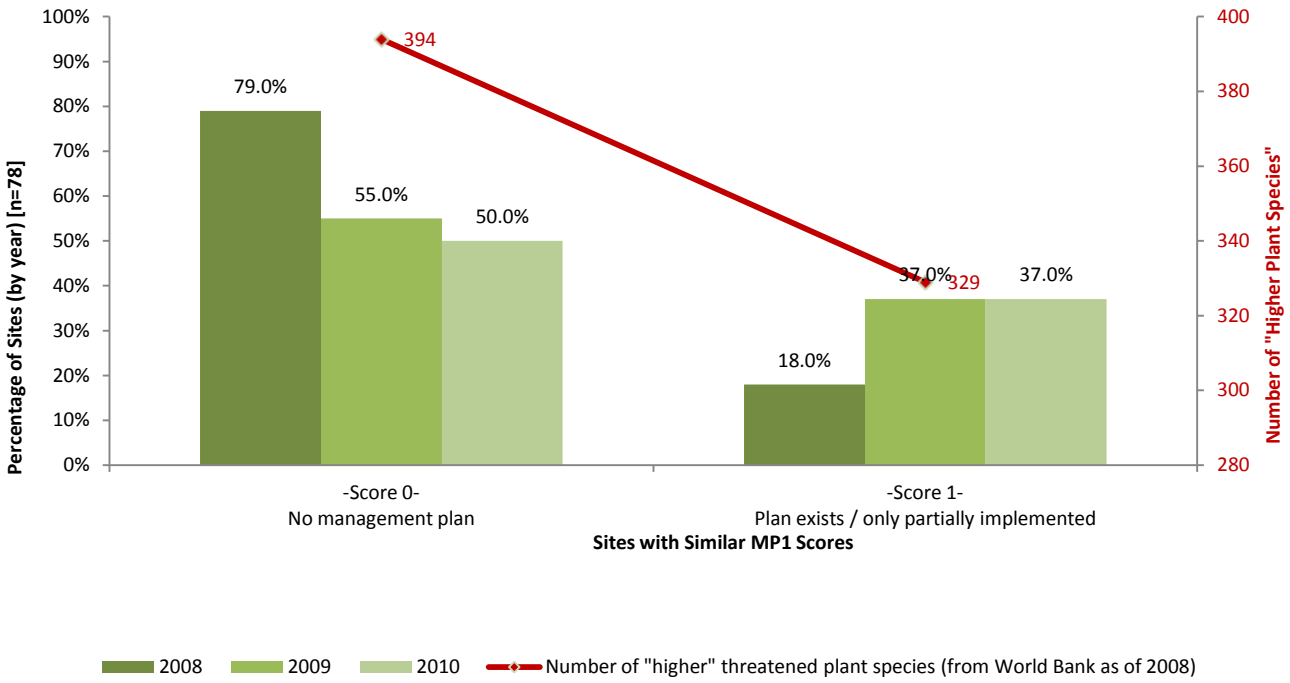


Figure 7.5 Management Plan and Education Levels: Literacy Rate

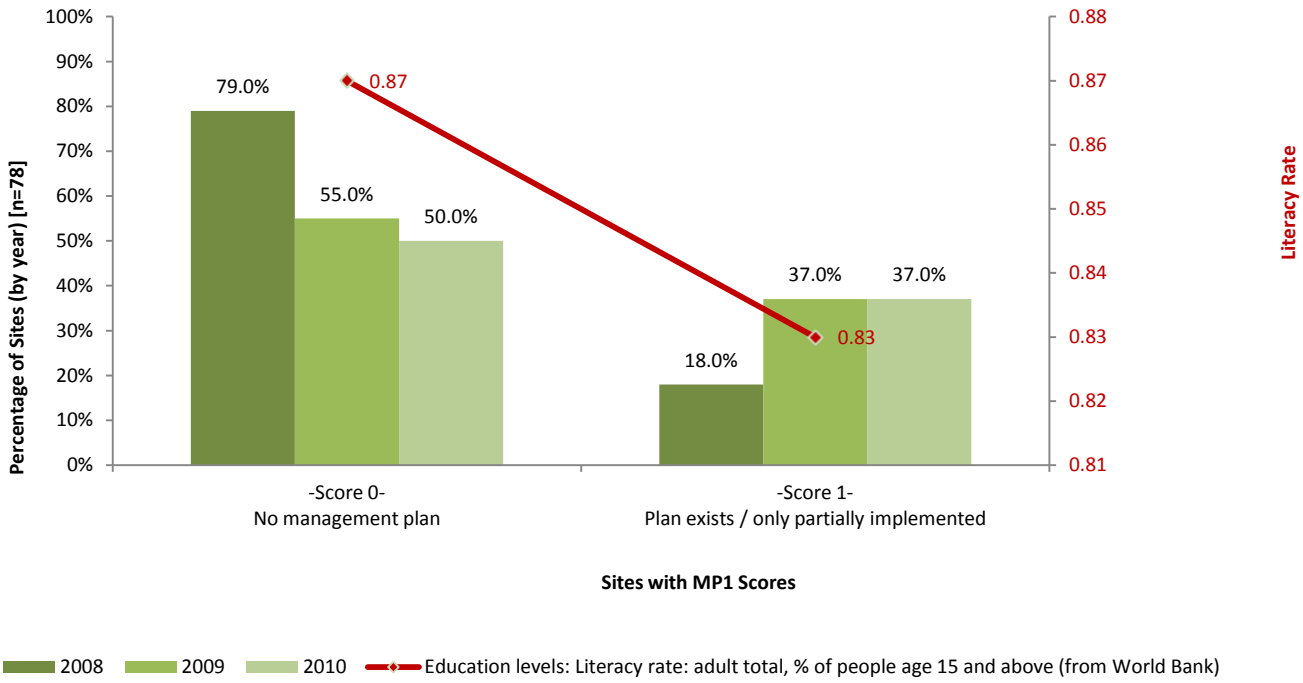


Figure 7.6 Management Plan and GNI per capita

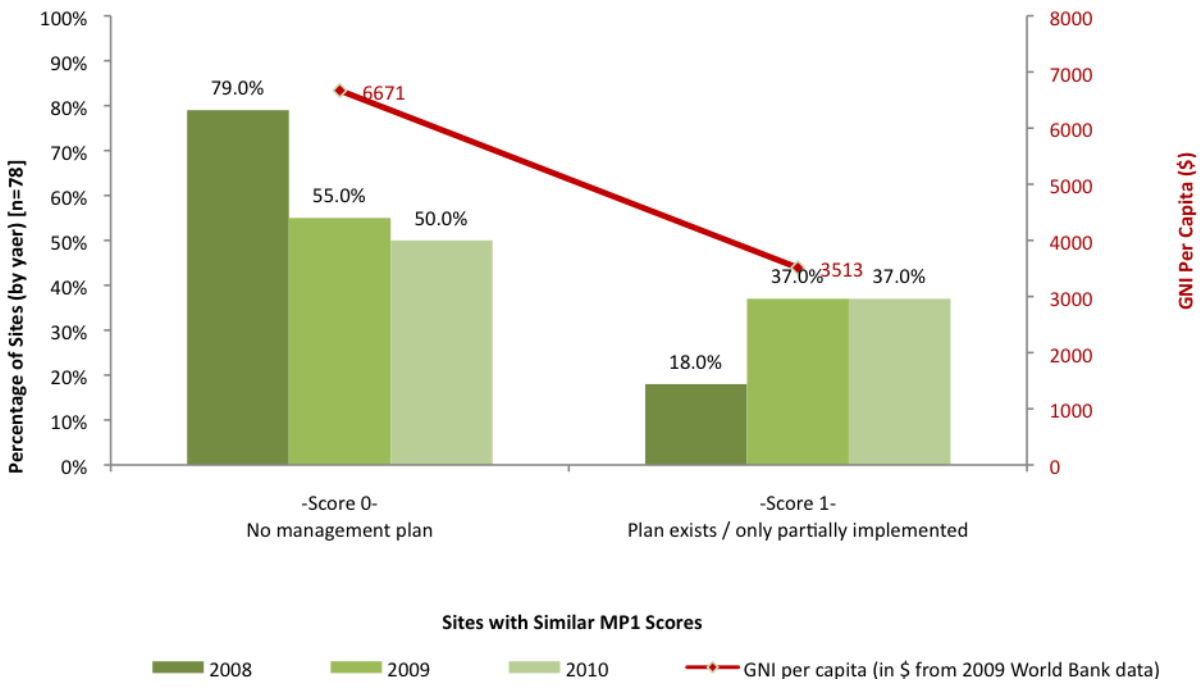


Figure 7.7 Management Plan and HDI Scores

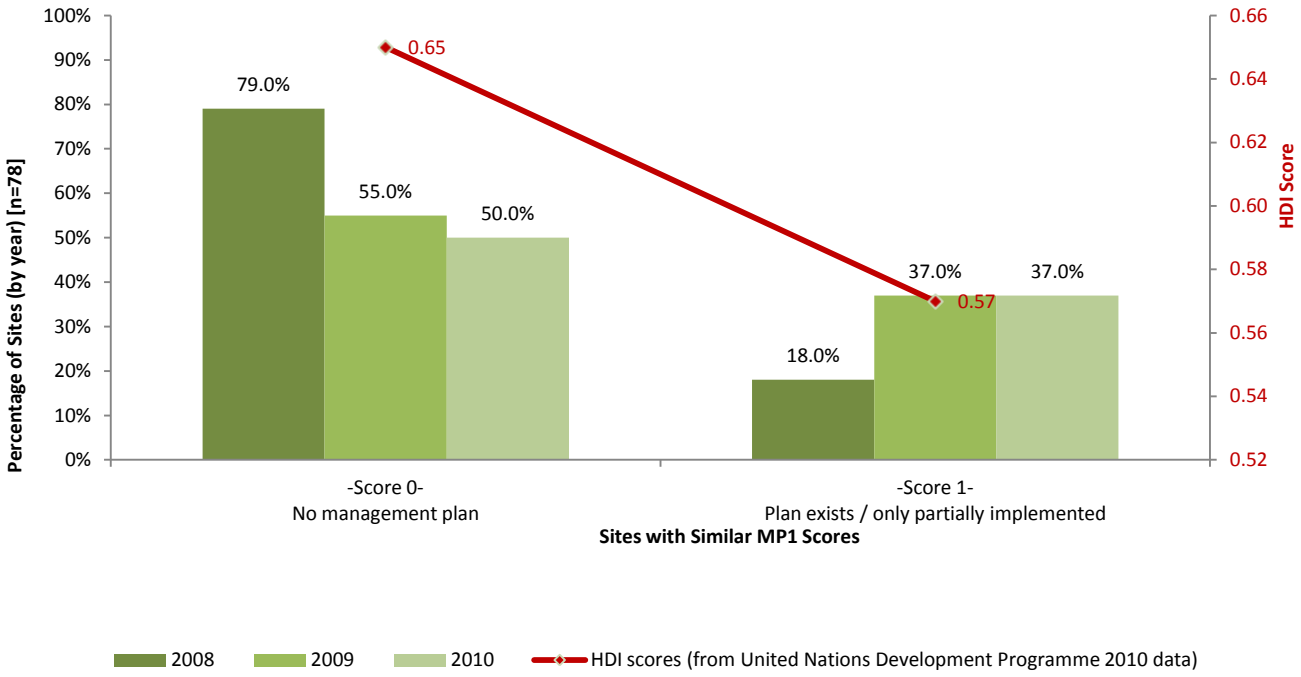


Figure 7.8 Management Plan and Growth Rates

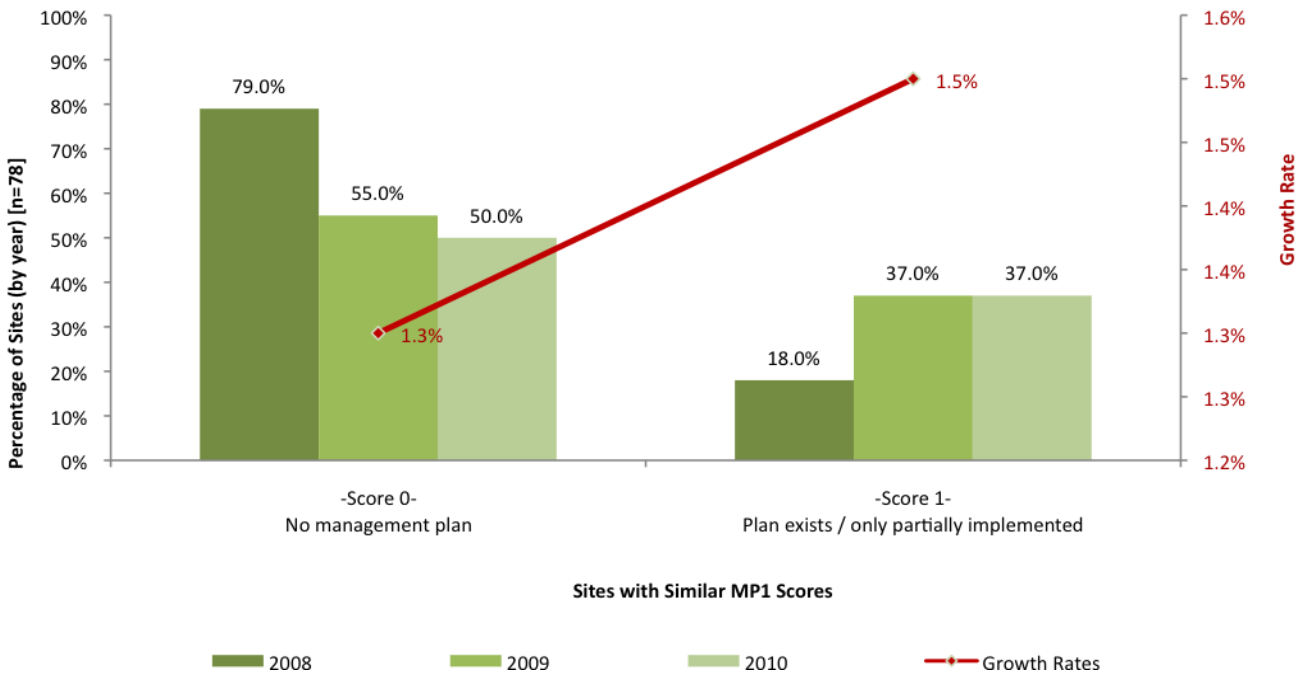


Figure 7.9 Management Plan and Urbanization Rate

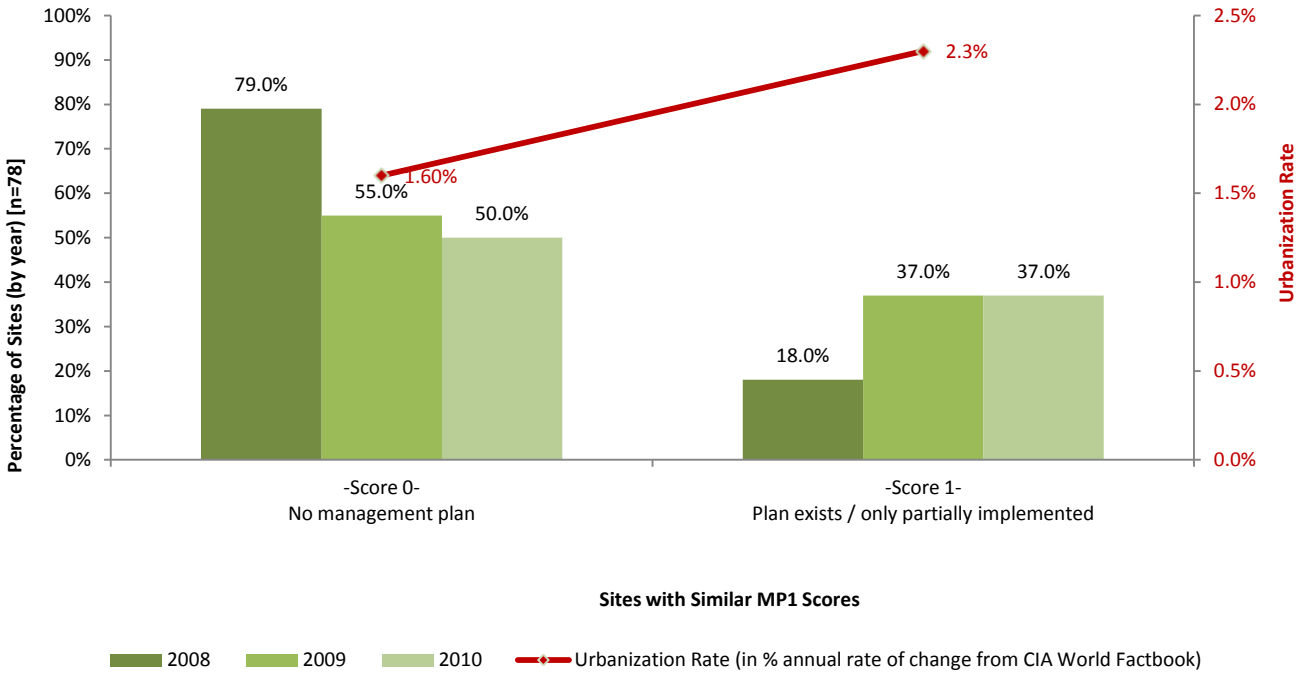


Figure 8.1 Species Action Plan

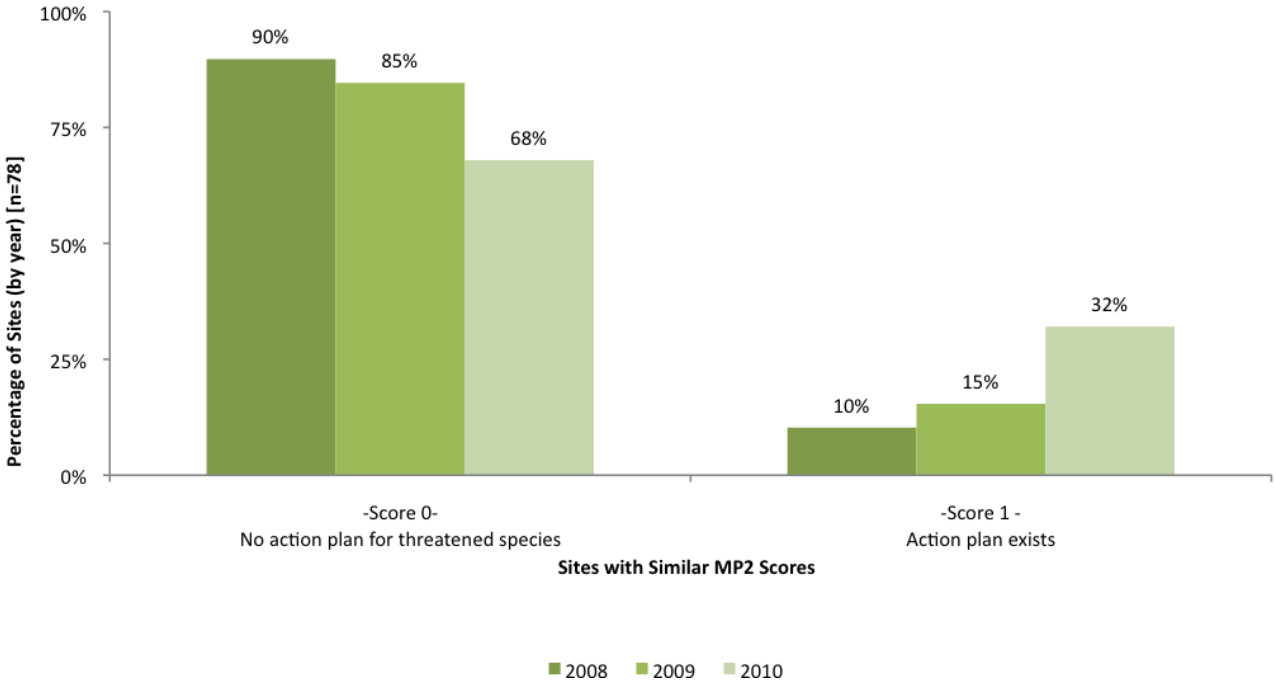


Figure 8.2 Species Action Plan and GNI per Capita

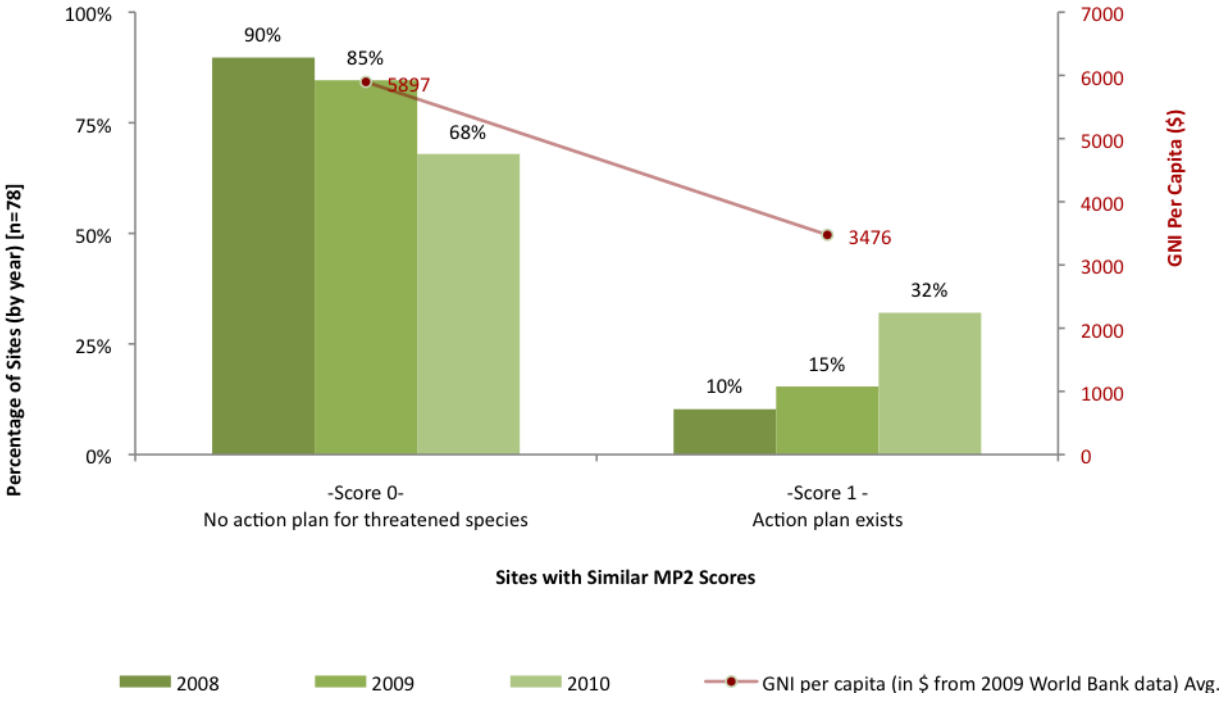


Figure 8.3 Species Action Plan and Endemic Species Distribution

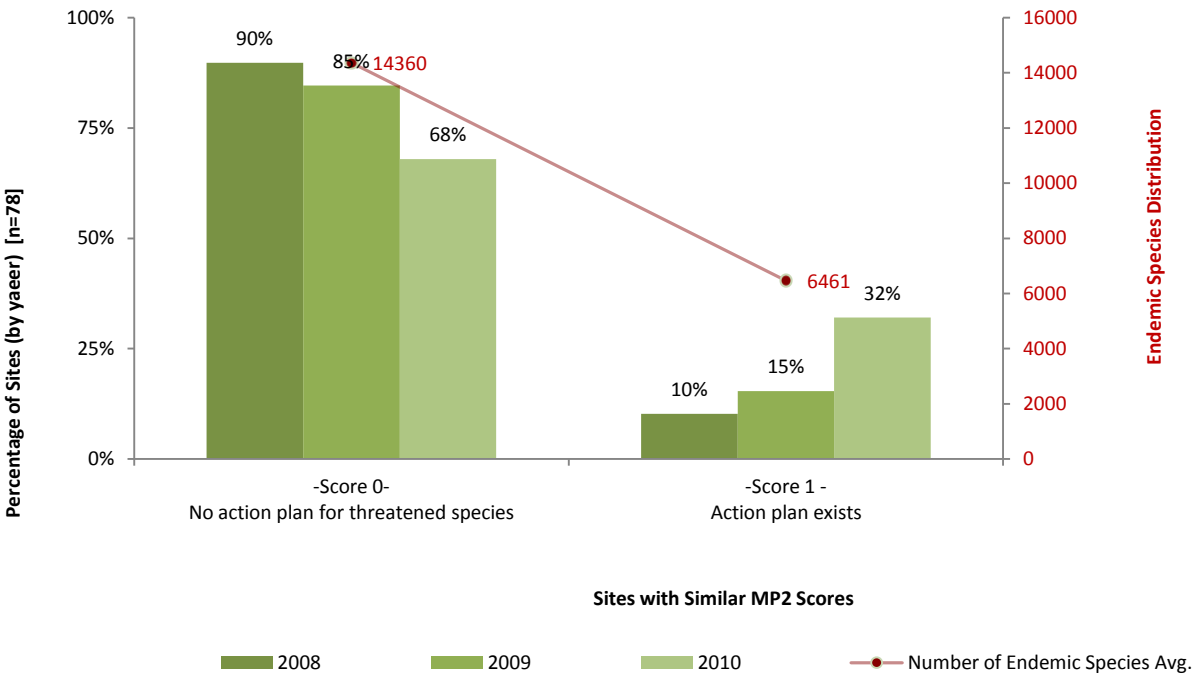


Figure 8.4 Species Action Plan and Education Levels: Expenditures

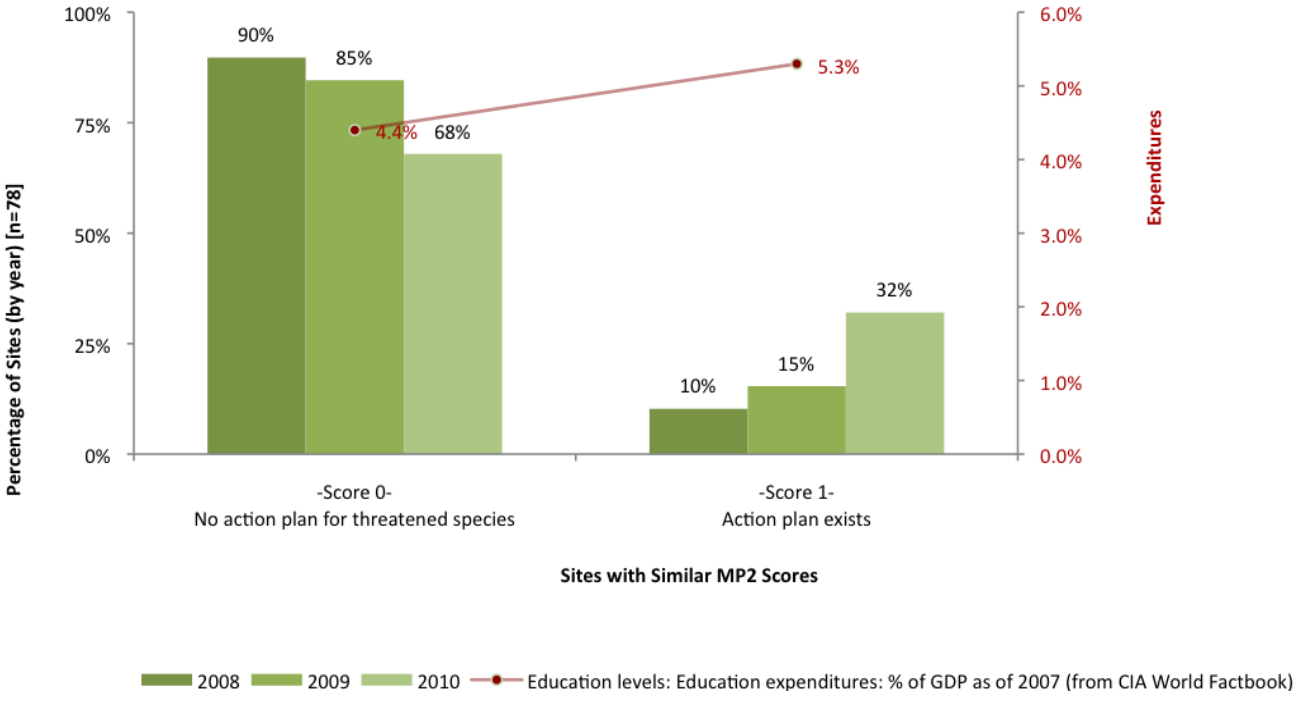


Figure 8.5 Species Action Plan and Number of "Higher" Threatened Plant Species

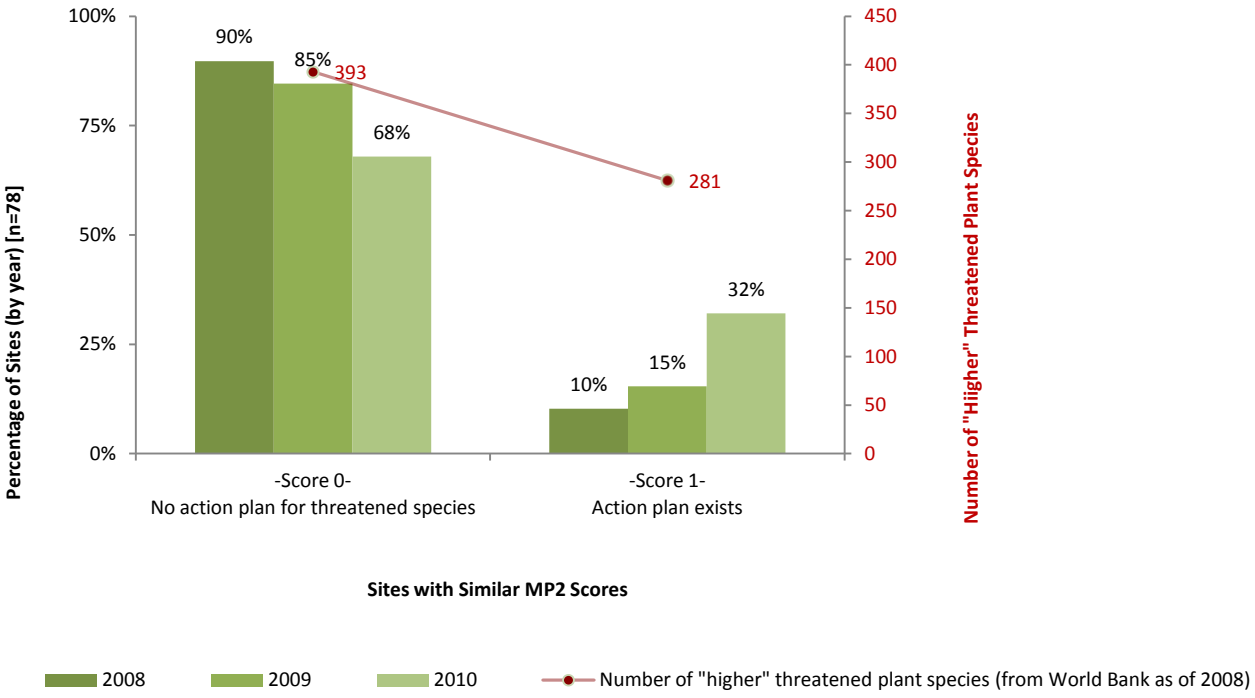


Figure 8.6 Species Action Plan and Education Levels: Literacy Rate

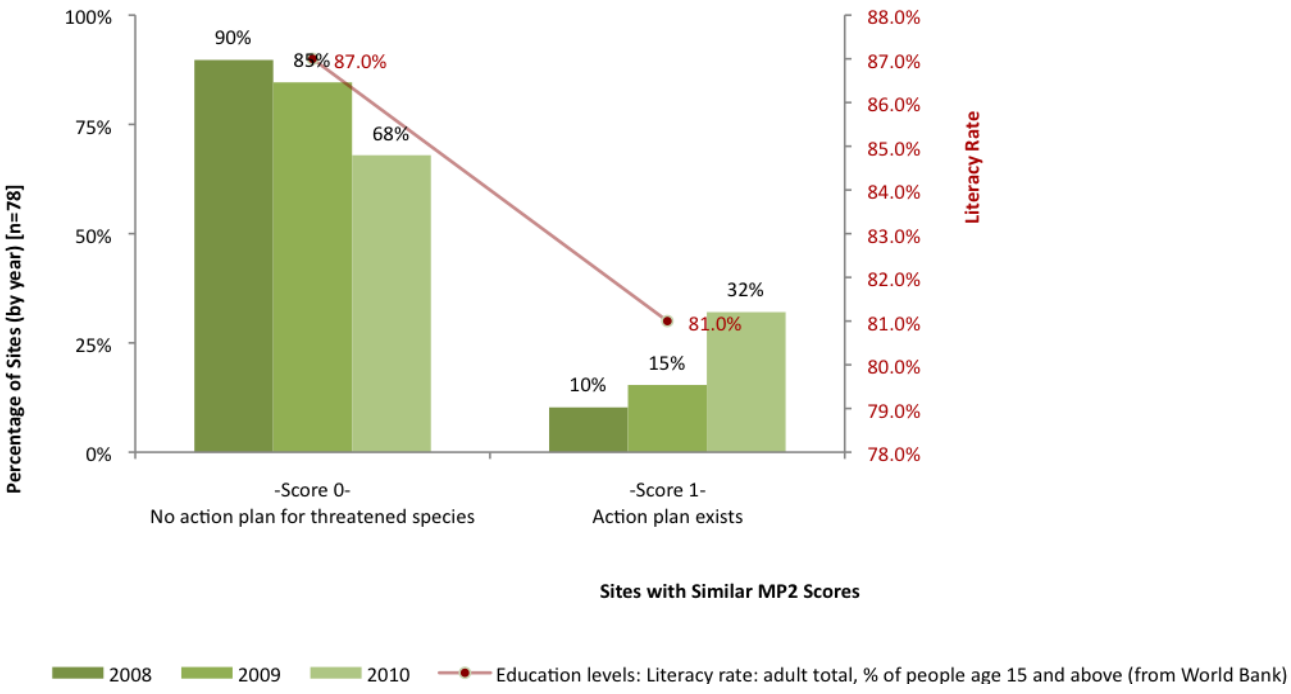


Figure 8.7 Species Action Plan and Population Density

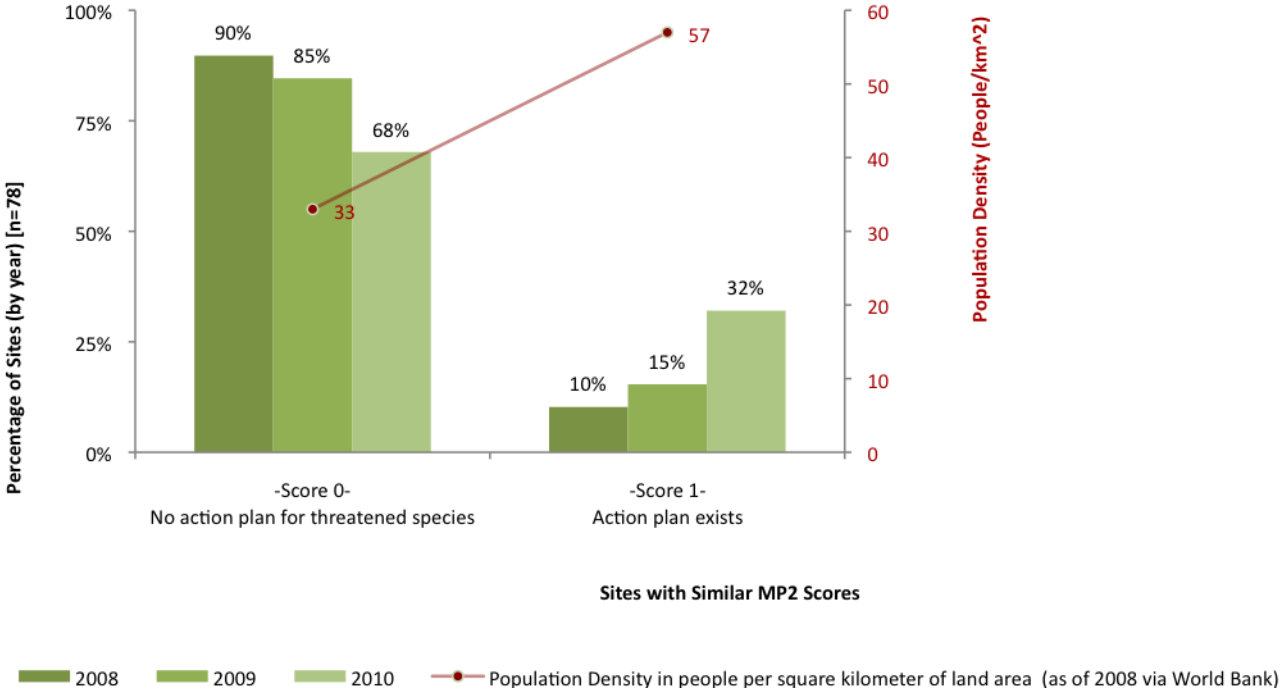


Figure 8.8 Species Action Plan and % of Population Urbanized

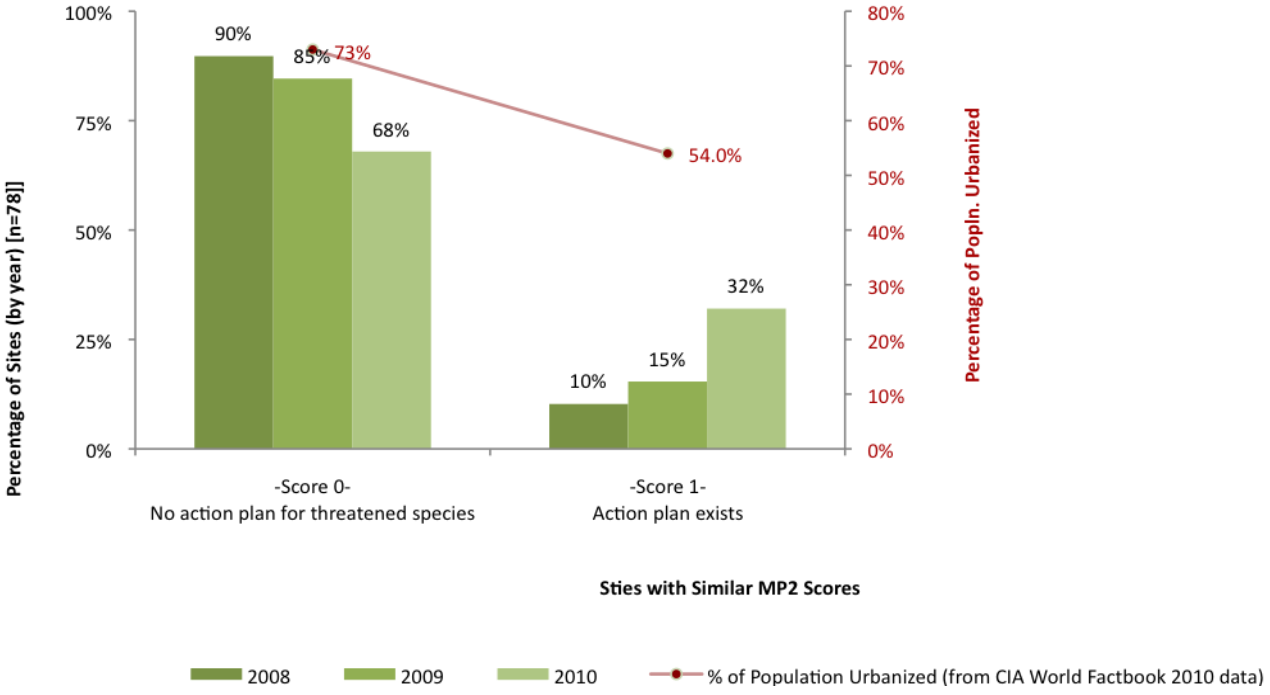


Figure 8.9 Species Action Plan and Urbanization Rate

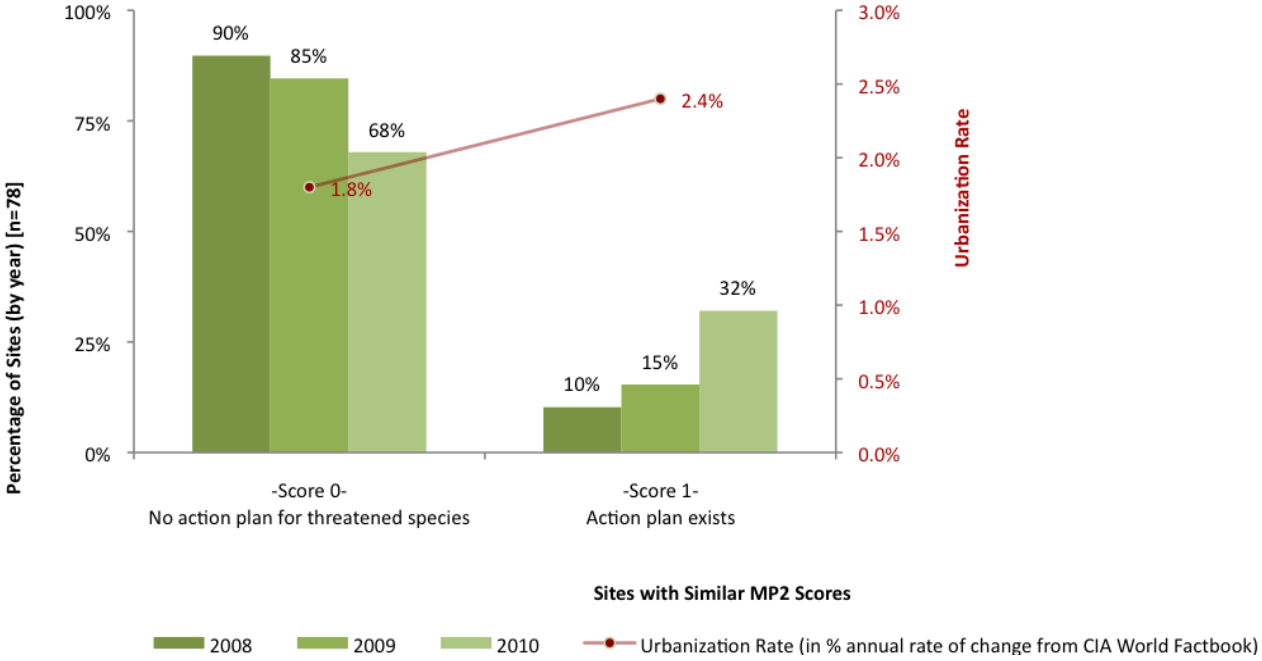


Figure 8.10 Species Action Plan and Growth Rate

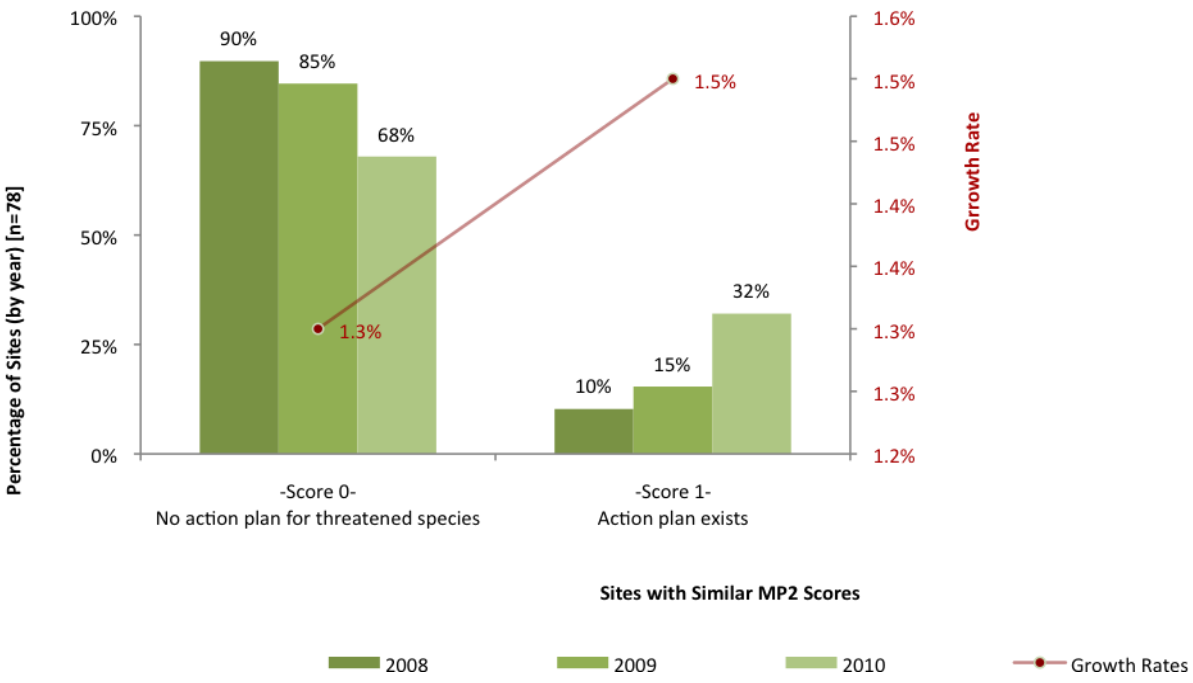


Figure 8.11 Species Action Plan and HDI Scores

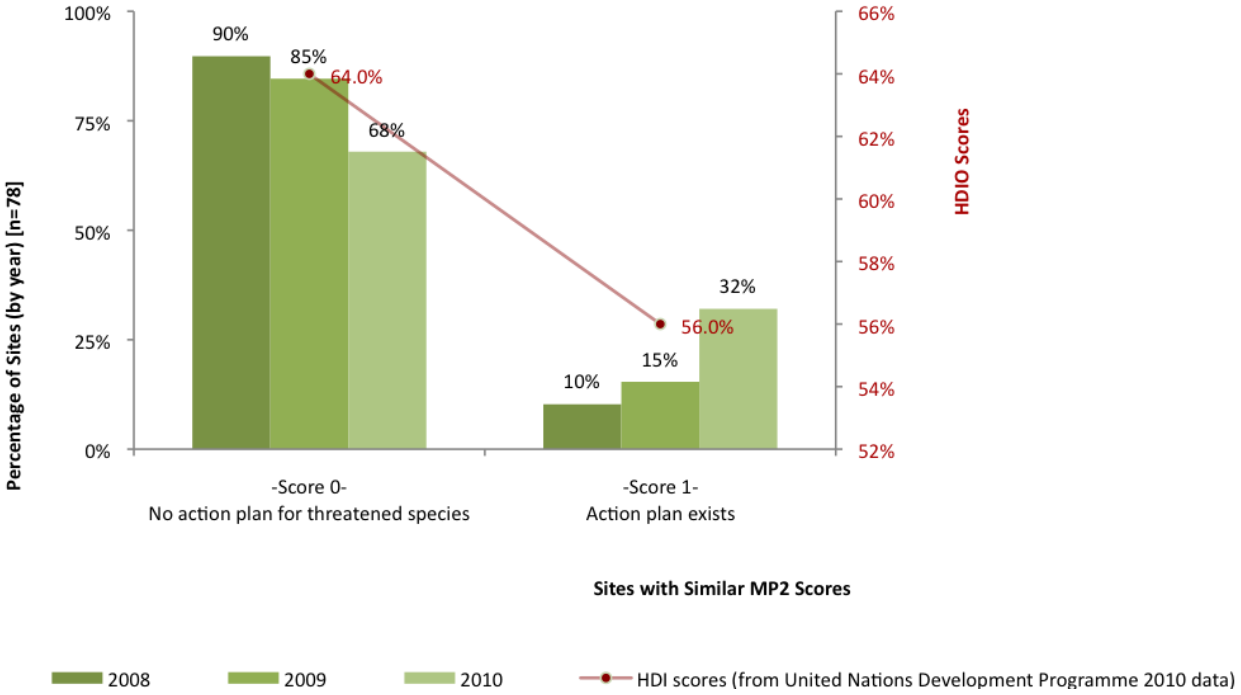


Figure 9.1 Education and Awareness Programs

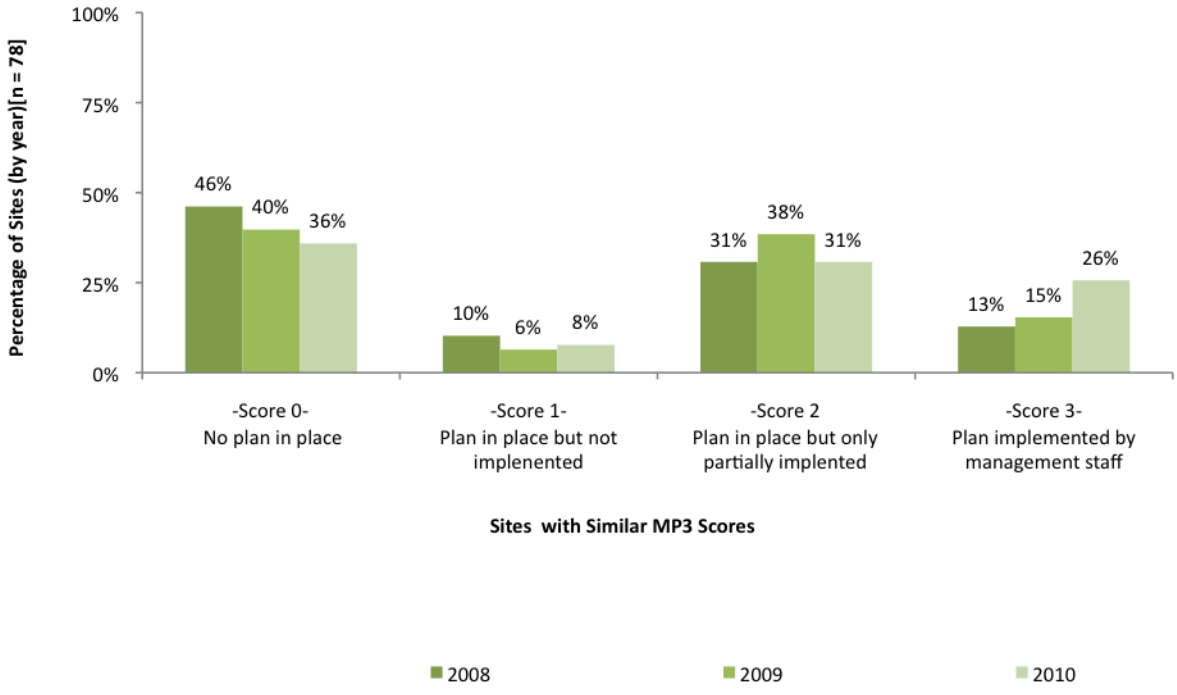


Figure 10.1 Monitoring and Evaluation Program and Education Level: Education Expenditure

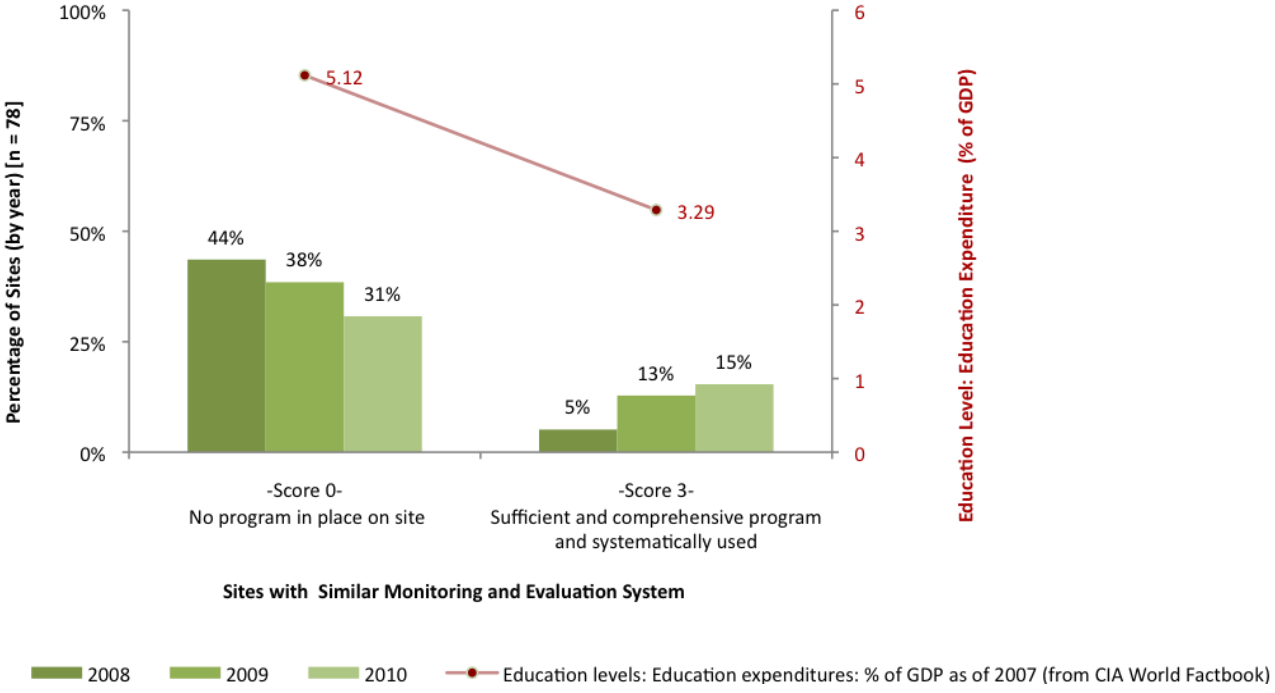


Figure 10.2 Monitoring and Evaluation Program and Education Expenditures

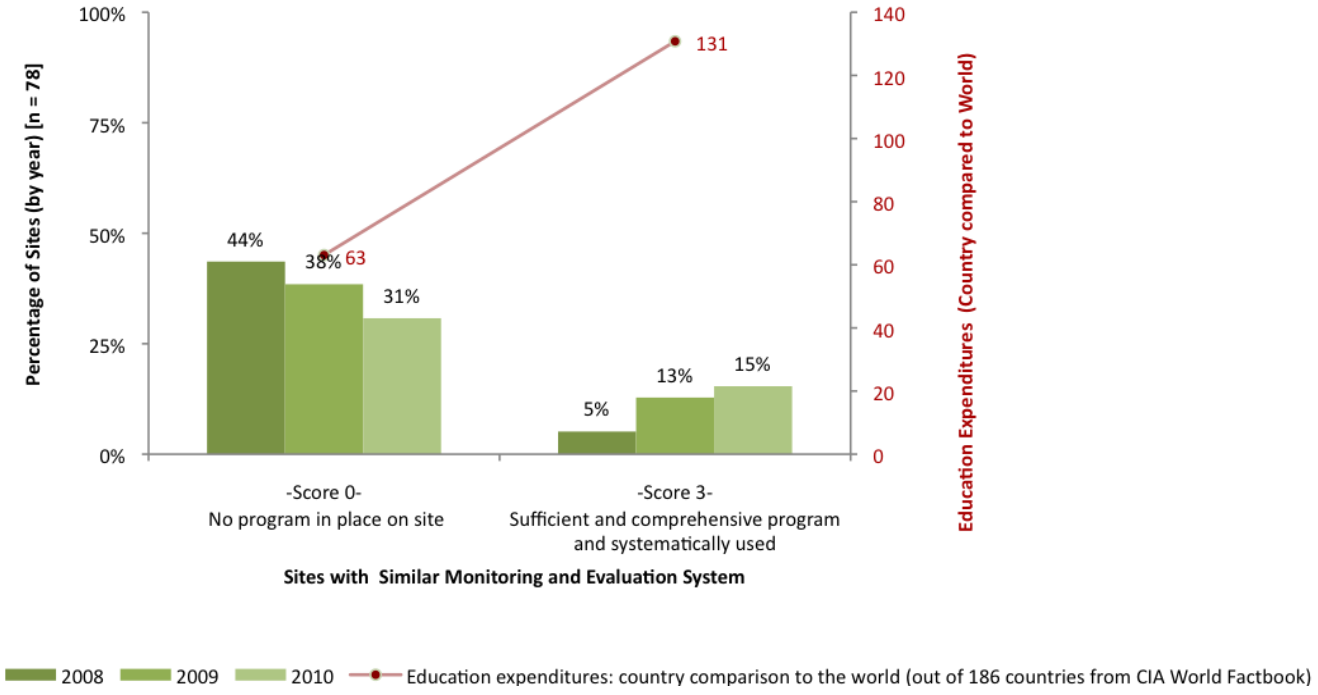


Figure 10.3 Monitoring and Evaluation System Percent of Population Urbanized

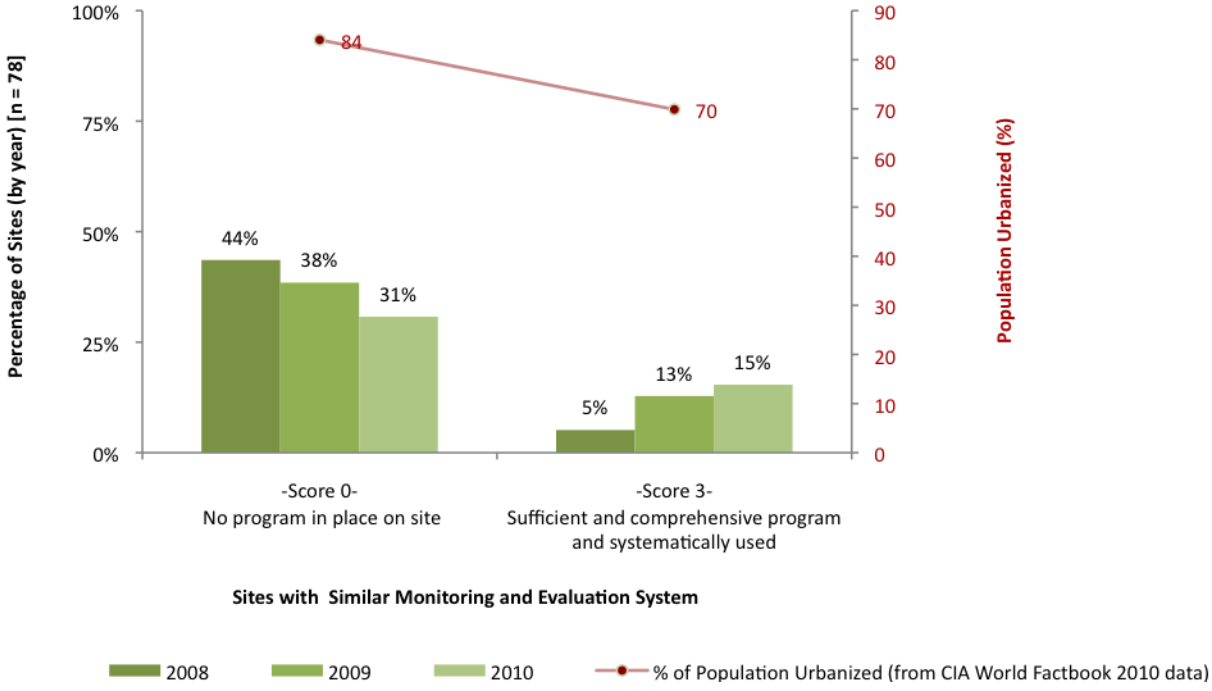


Figure 10.4 Monitoring and Evaluation System and Urbanization Rate

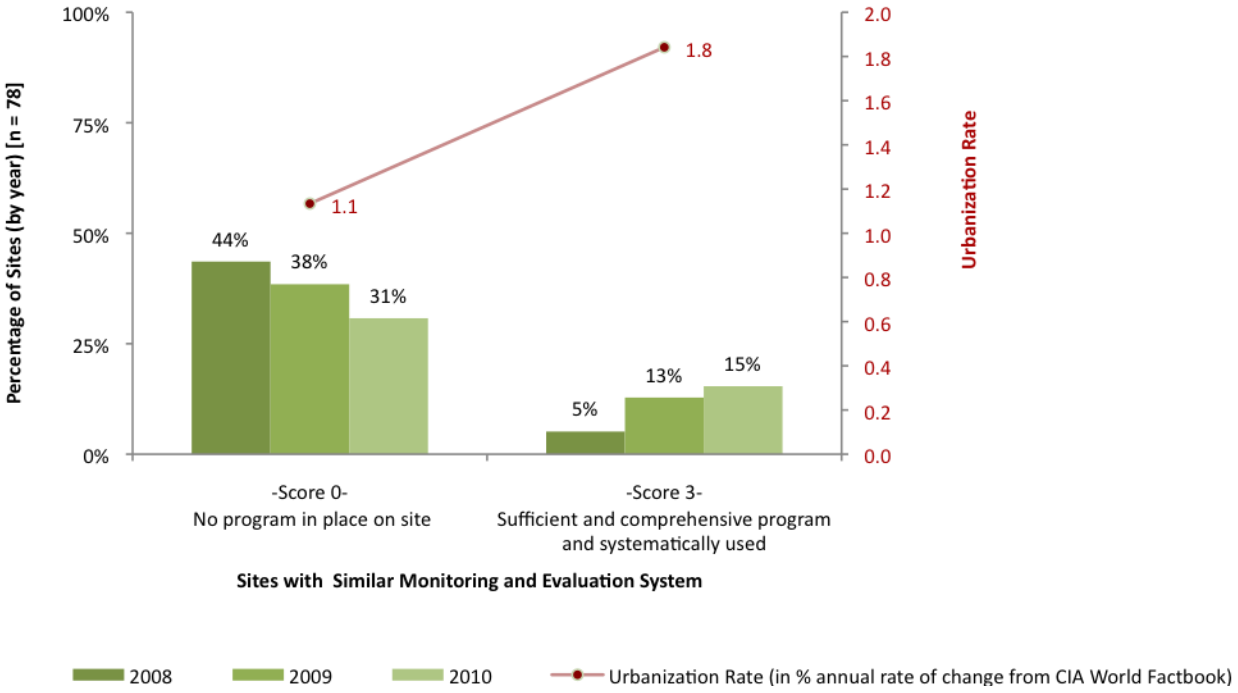


Figure 10.5 Monitoring and Evaluation System and Population Growth Rate

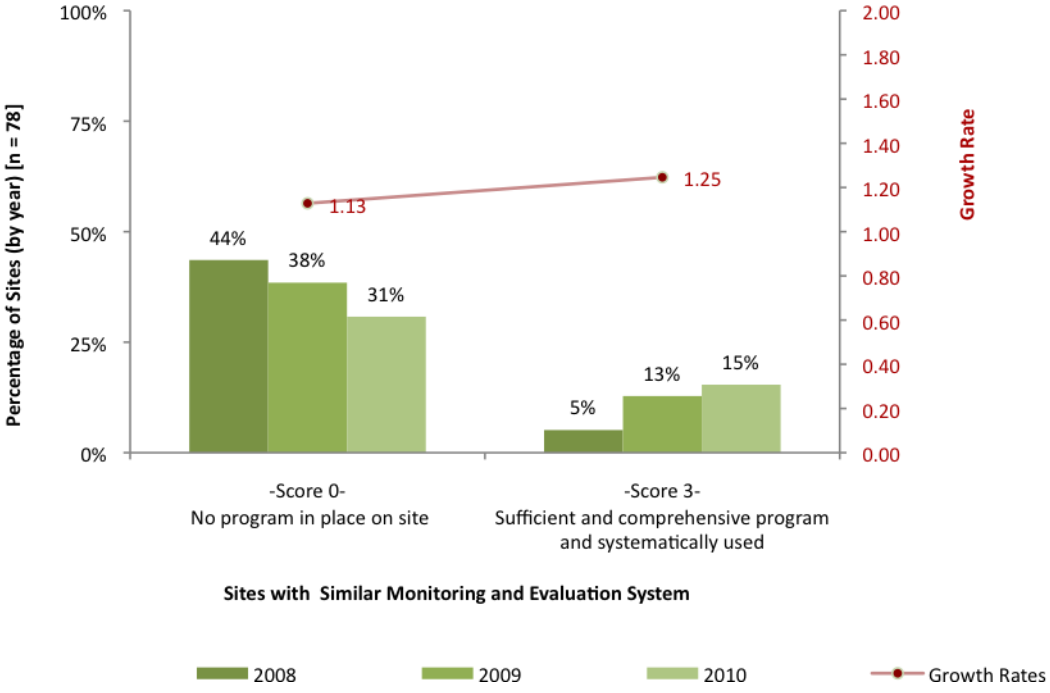


Figure 10.6 Monitoring and Evaluation System and Human Development Index

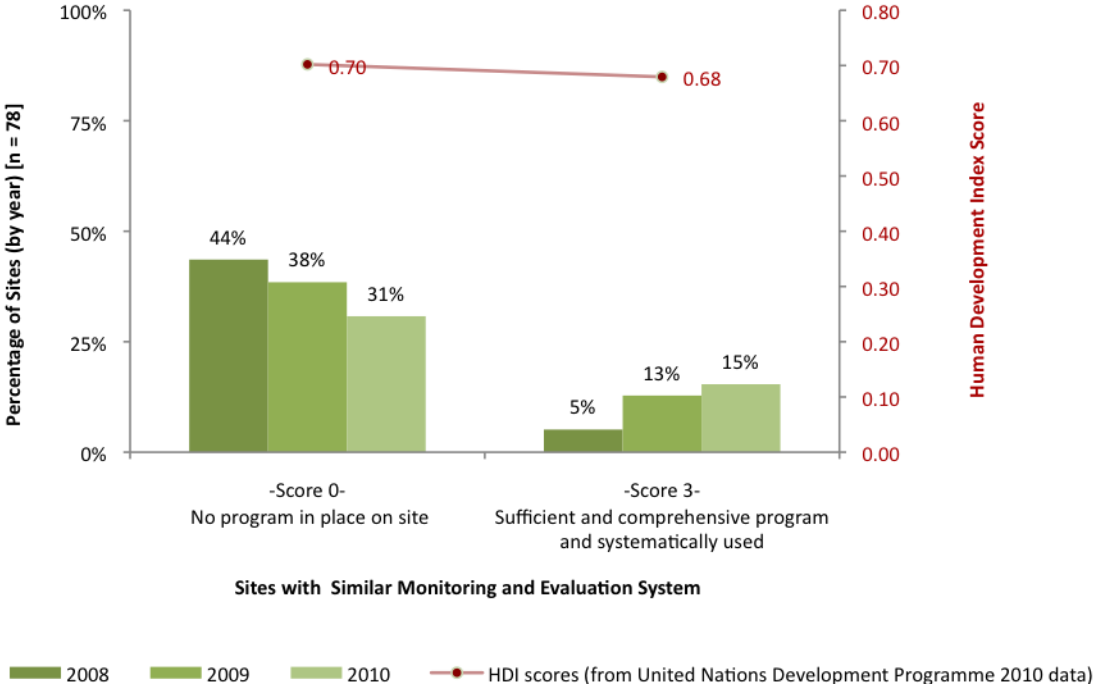


Figure 10.7 Monitoring and Development System and Gross National Income

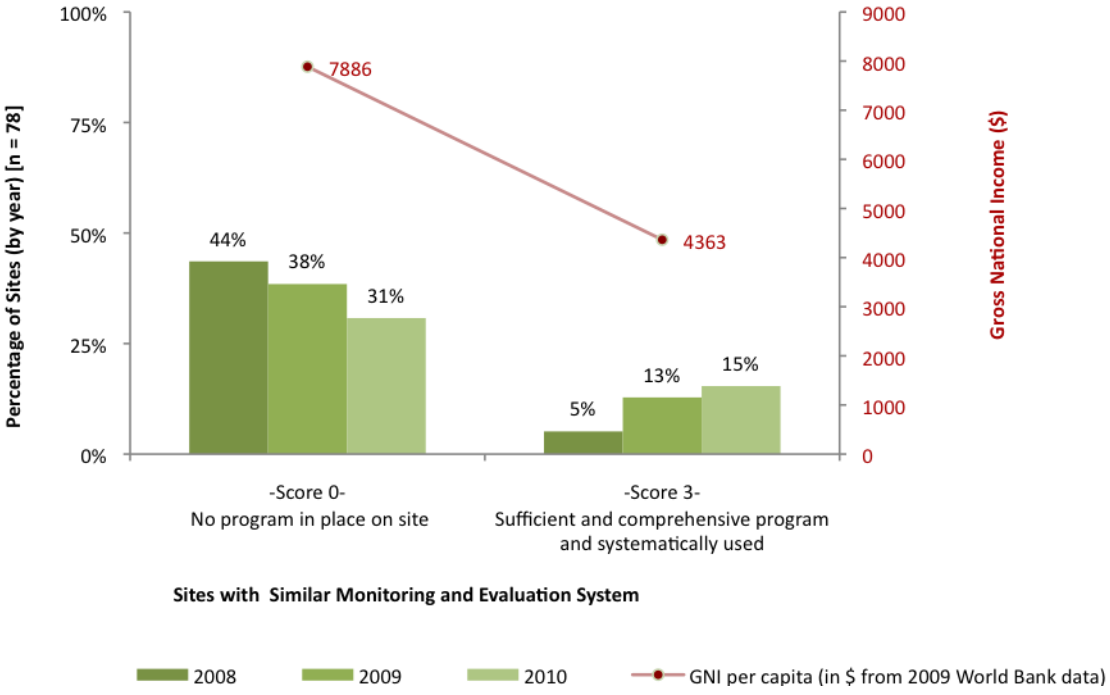


Figure 10.8 Monitoring and Development System and Literacy Rate

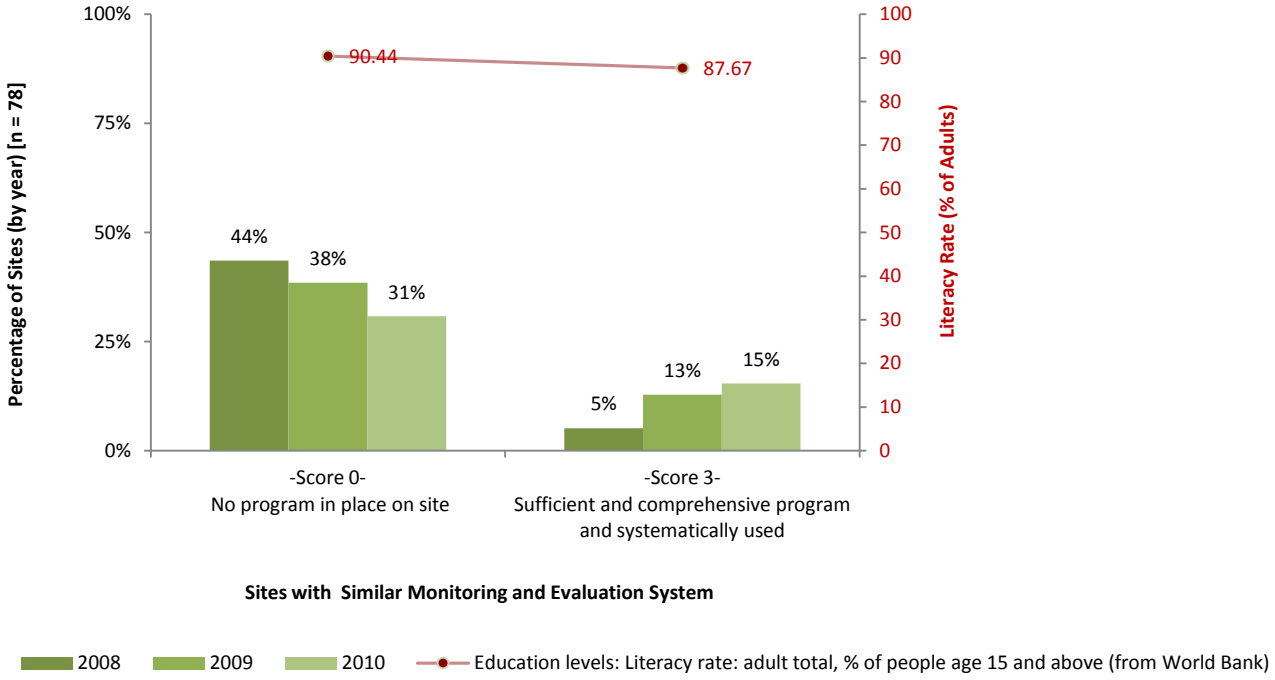


Figure 10.9 Monitoring and Evaluation System and Number of Endemic Species

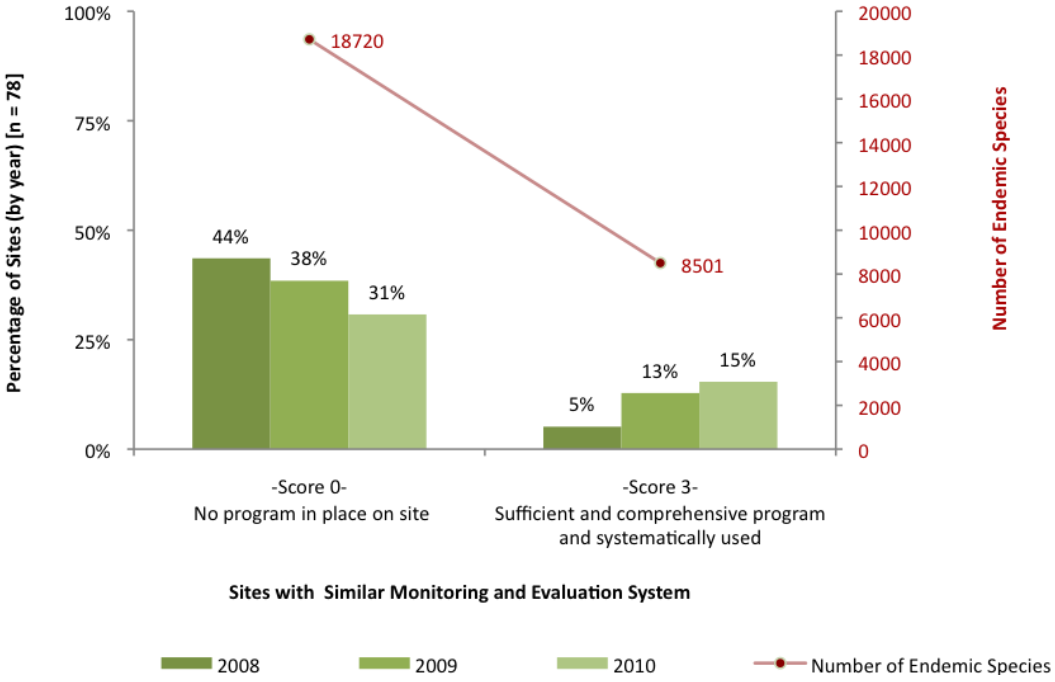


Figure 10.10 Monitoring and Evaluation Program and Education Level: Education Expenditure

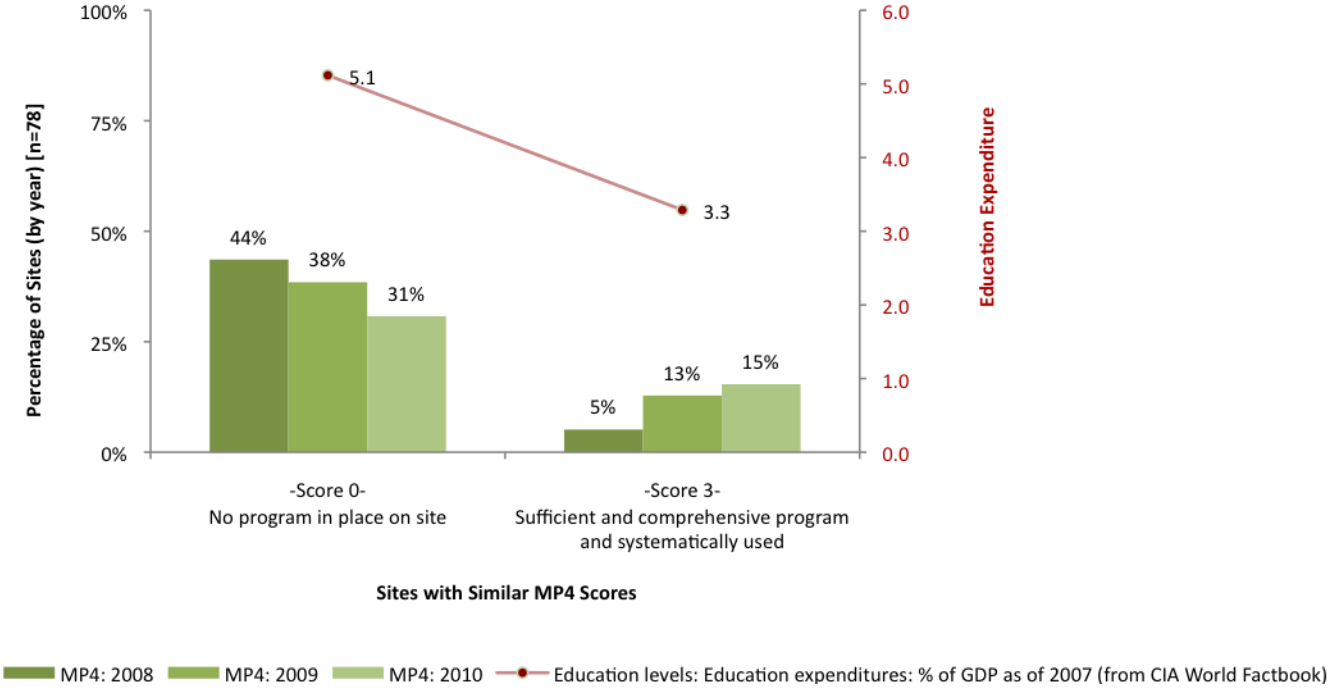


Figure 10.11 Monitoring and Evaluation Program and Education Expenditures

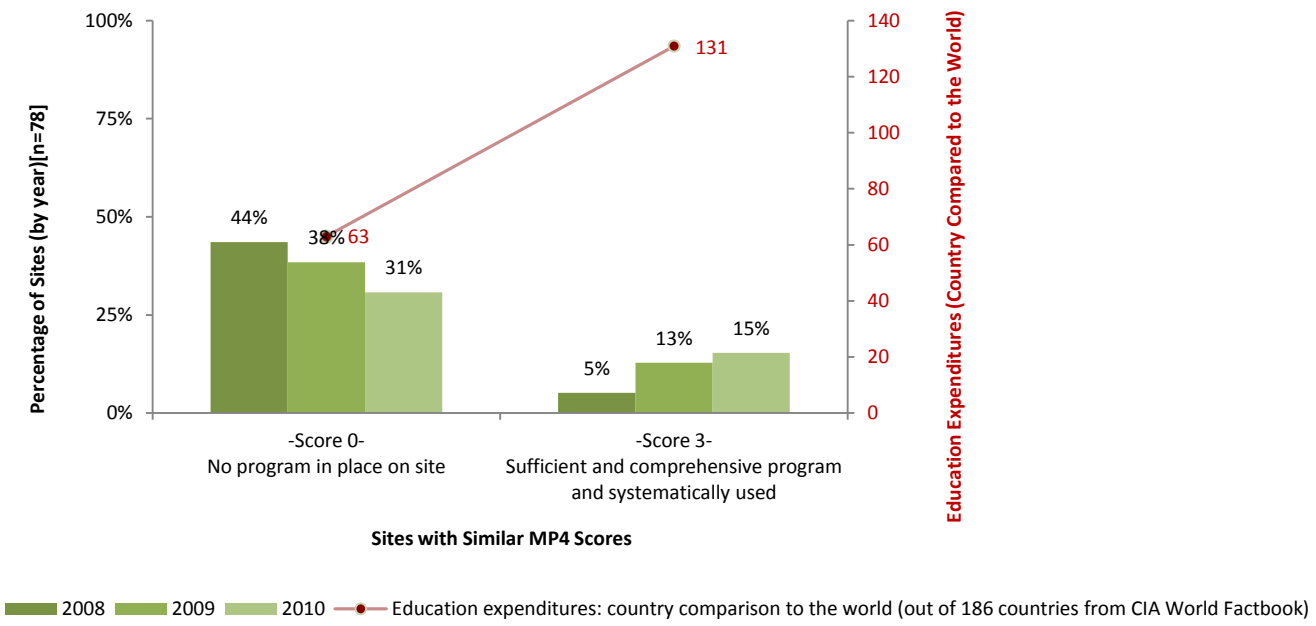


Figure 10.12 Monitoring and Evaluation Program and Number of Endemic Species

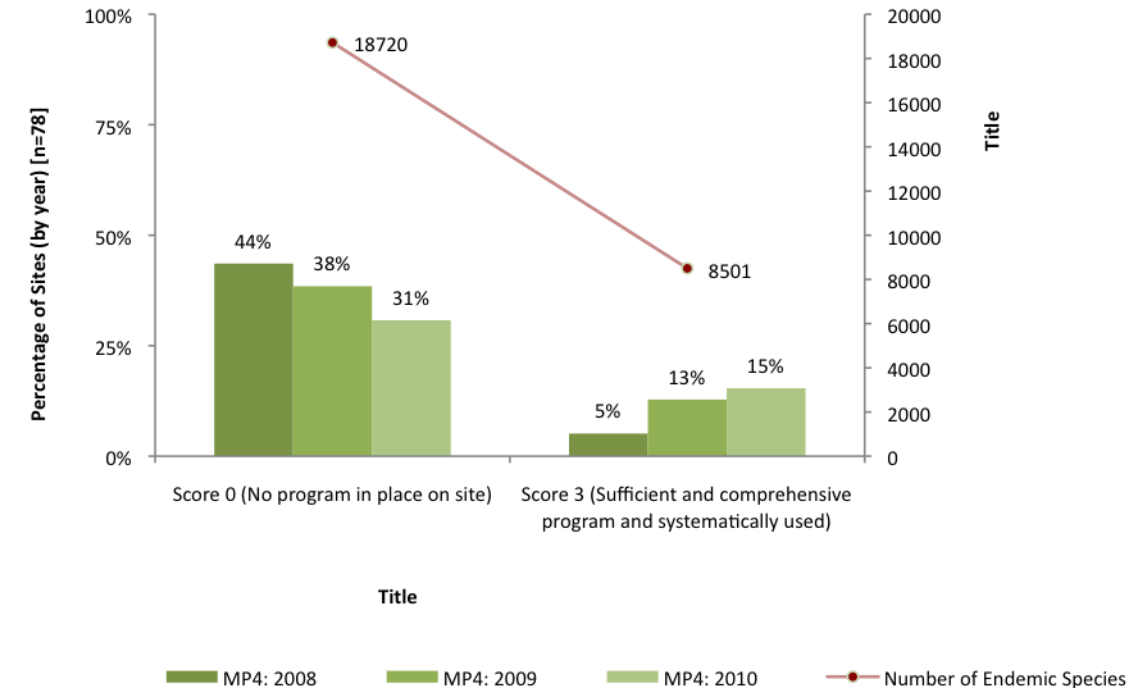


Figure 11.1 Financial Plan in Place and Population Density

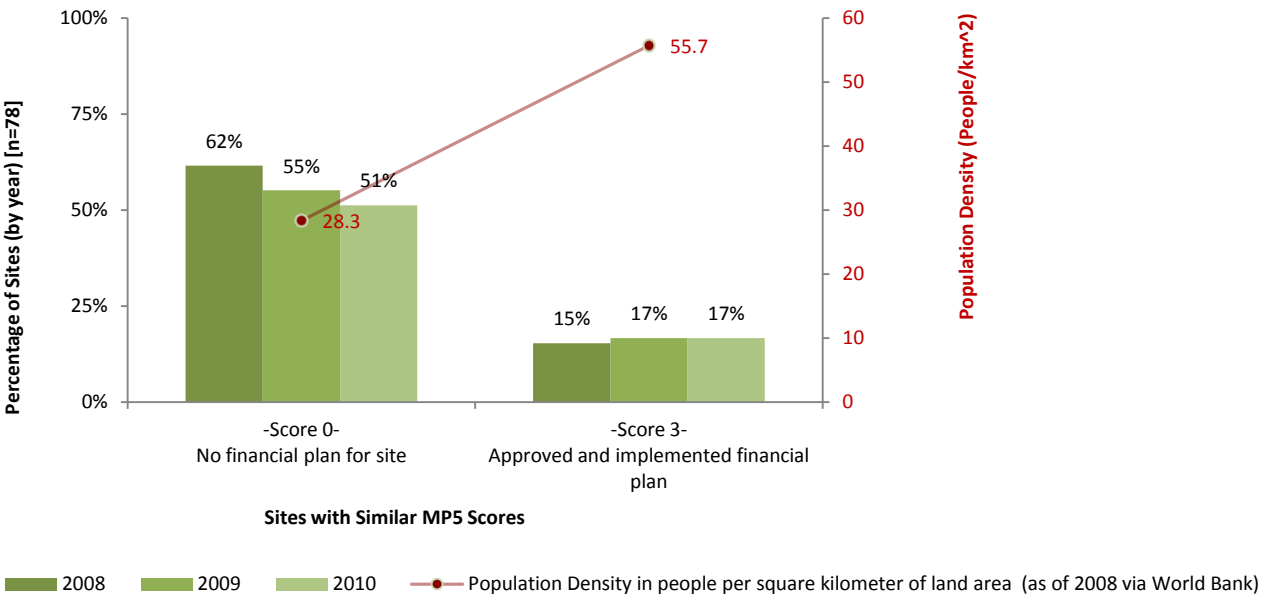


Figure 11.2 Financial Plan in Place and Percent of Population Urbanized

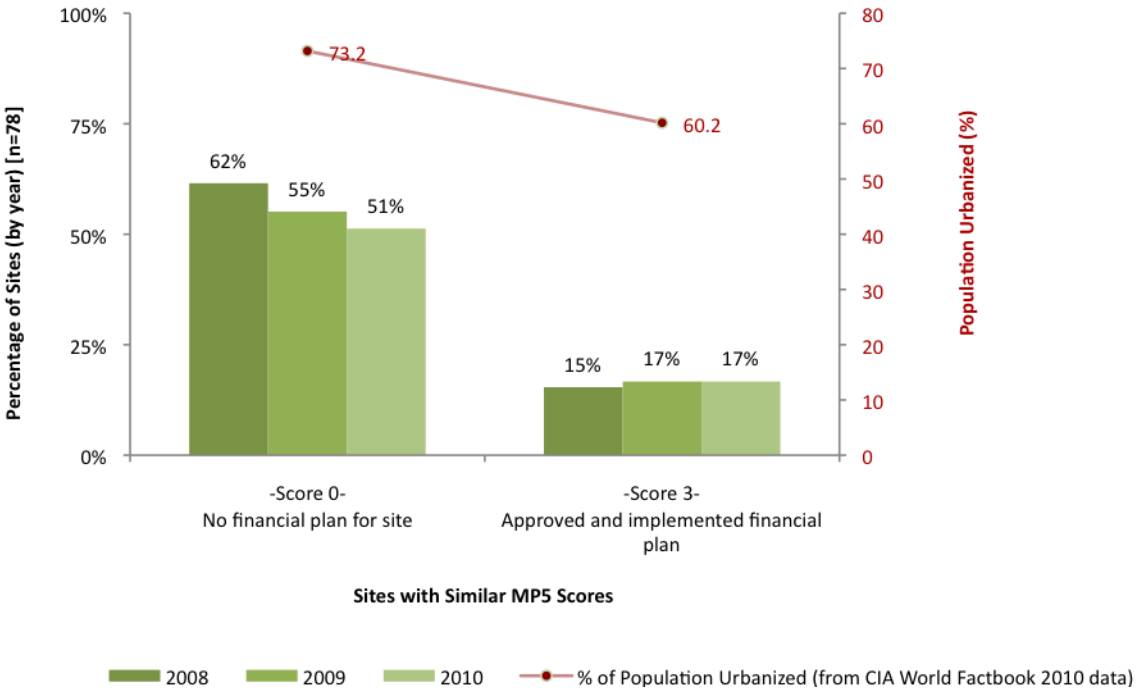


Figure 11.3 Financial Plan in Place and Urbanization Rates

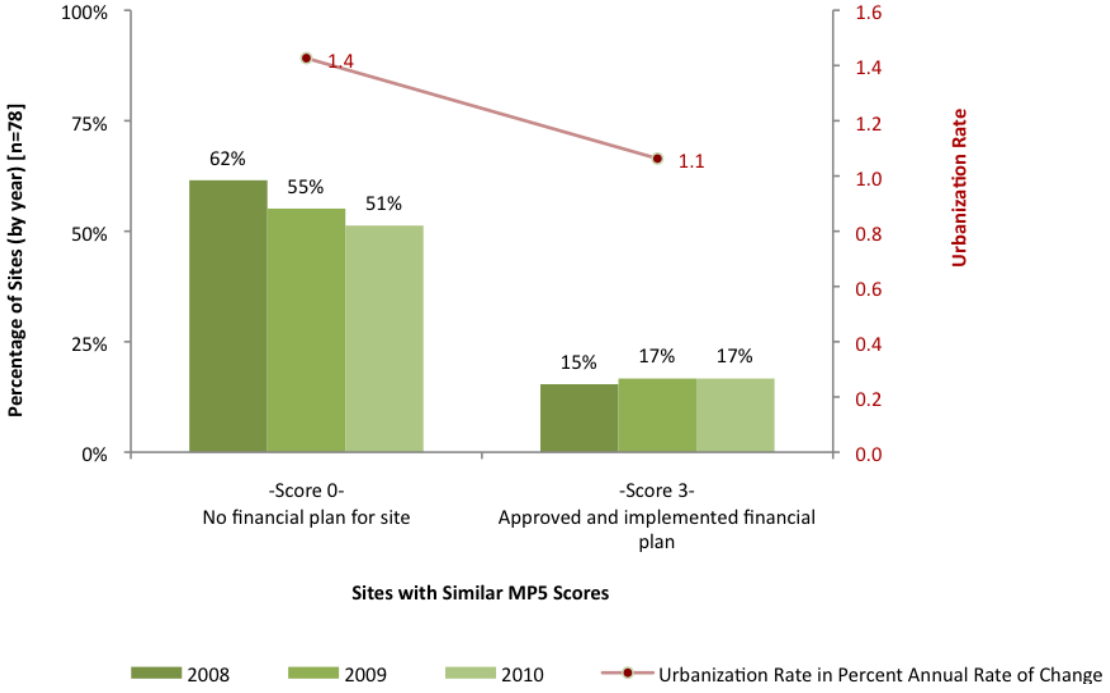


Figure 11.4 Financial Plan in Place and HDI Scores

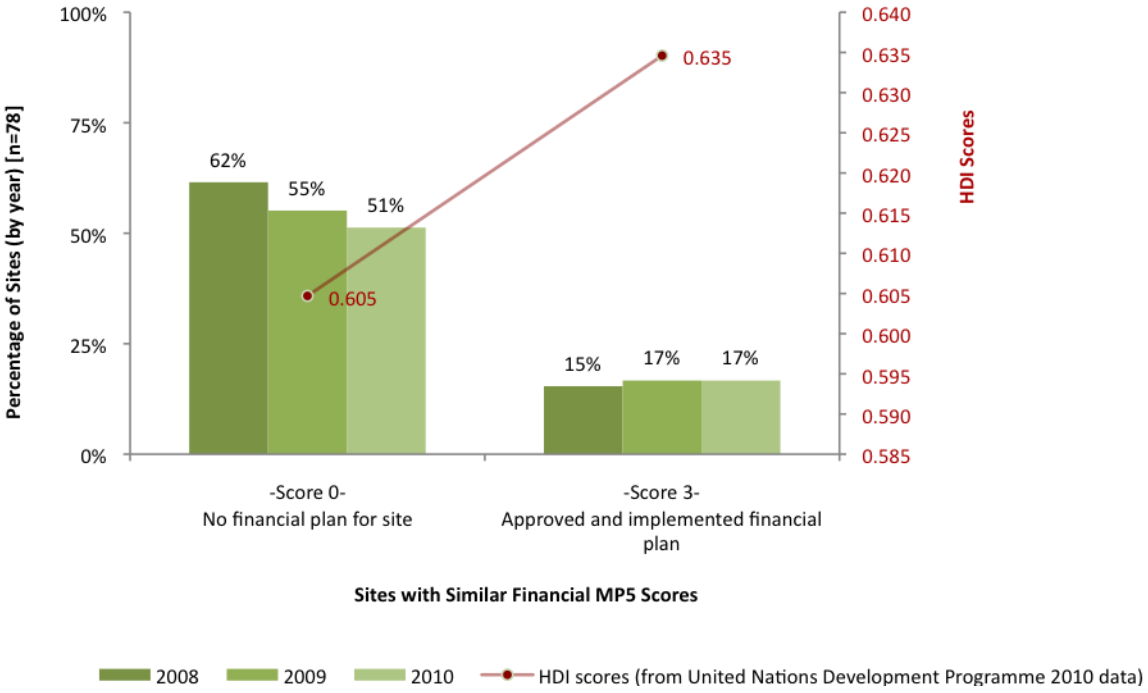


Figure 11.5 Financial Plan in Place and GNI per Capita

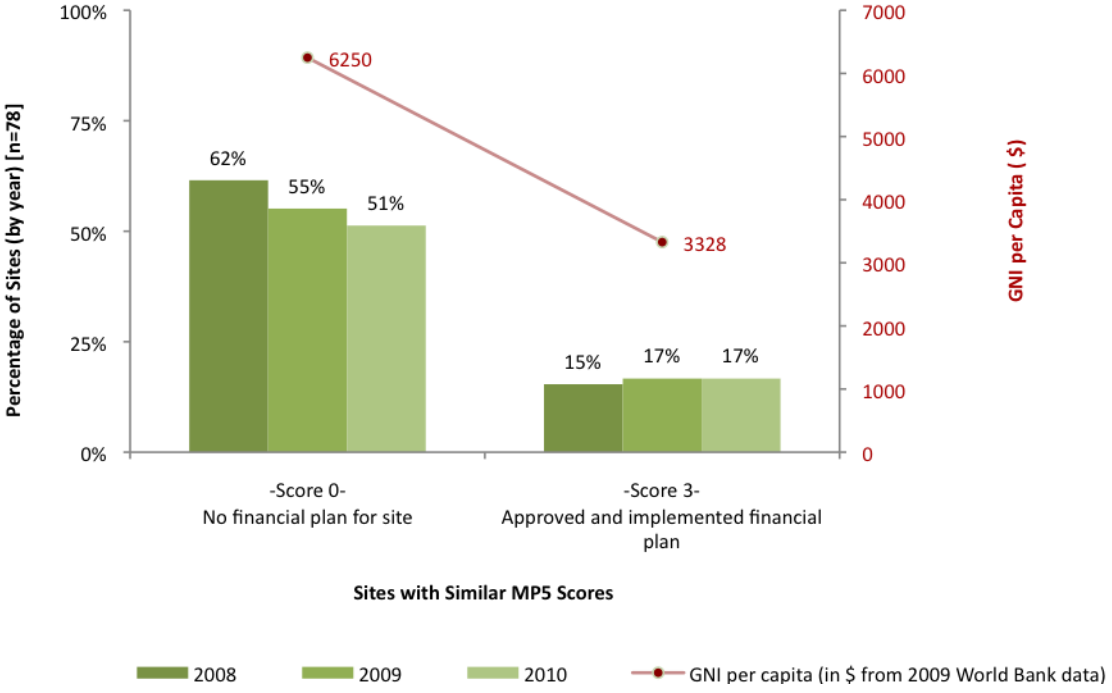


Figure 11.6 Financial Plan in Place and Education Levels: Literacy Rate

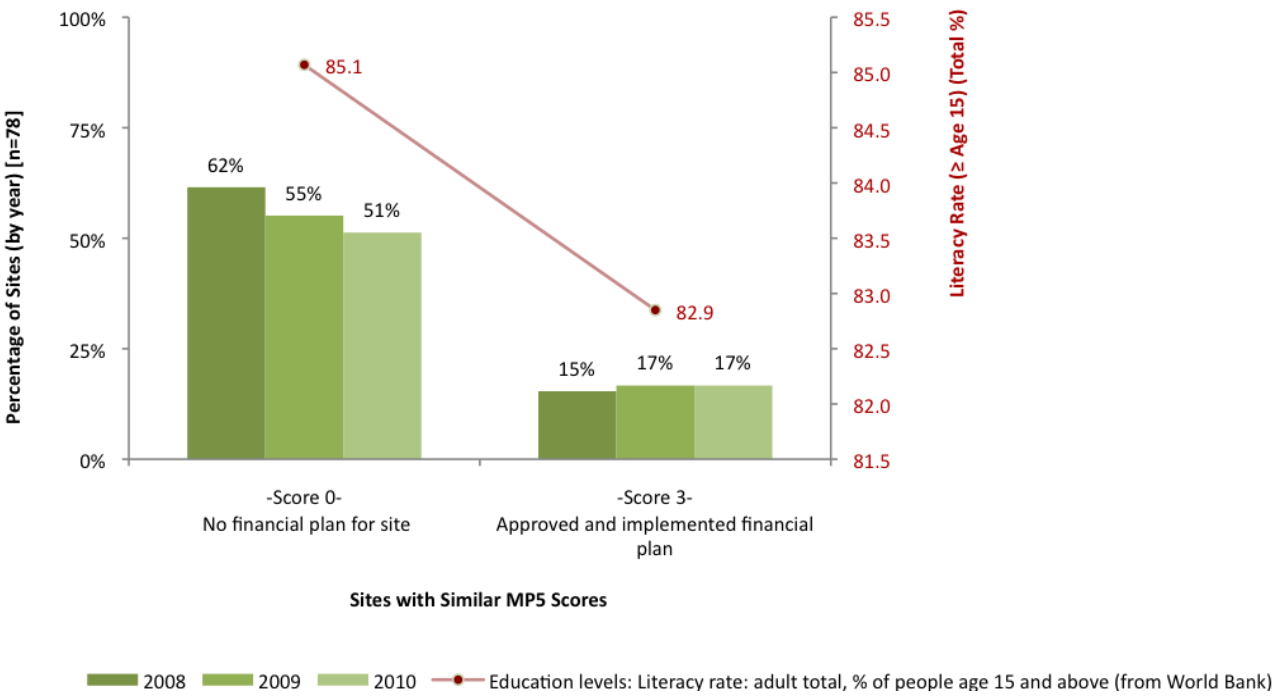


Figure 11.7 Financial Plan in Place and Education Levels: Education Expenditures

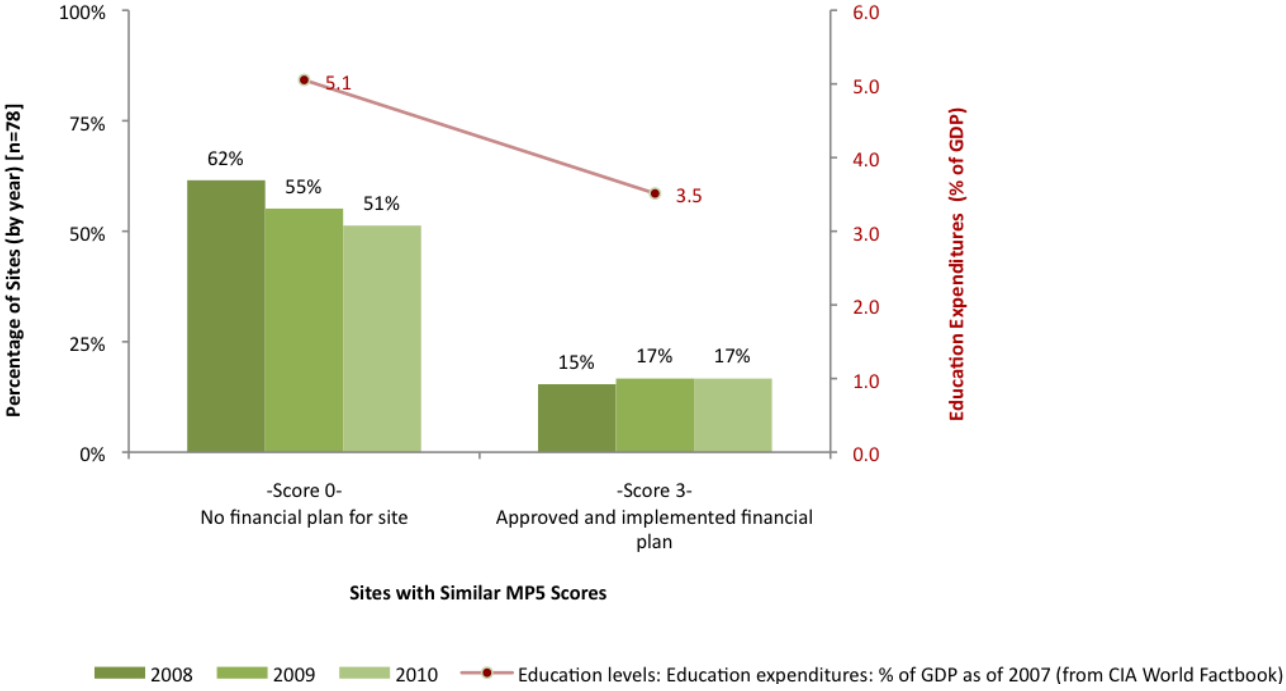


Figure 11.8 Financial Plan in Place and Education Expenditures (Country Comparison)

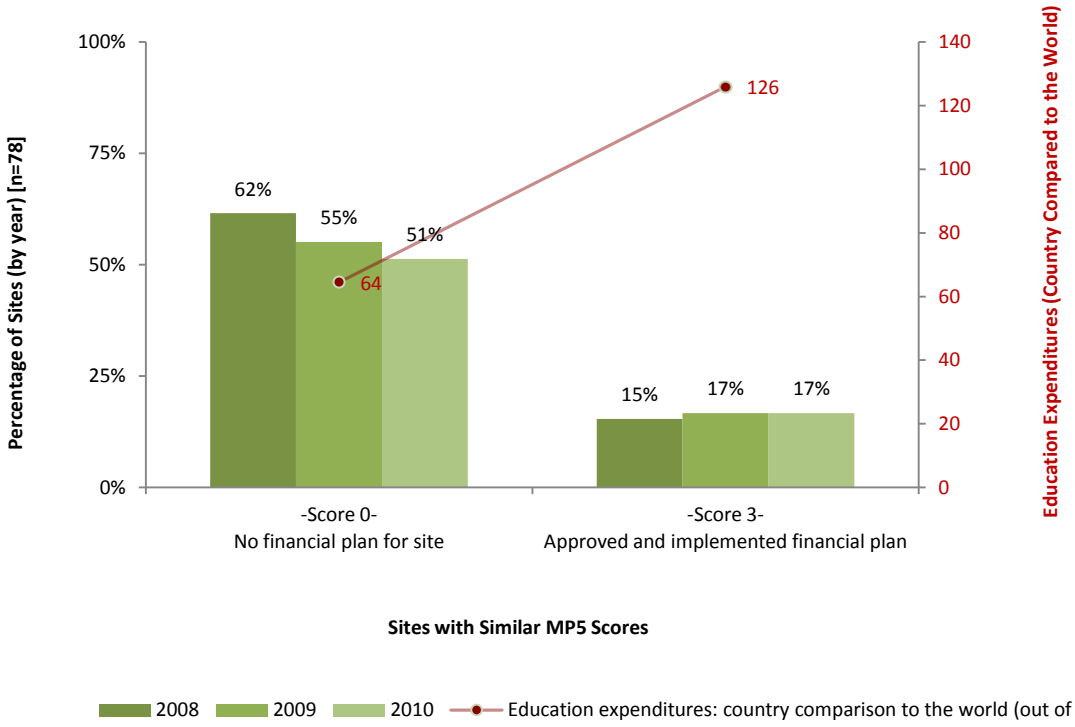


Figure 11.9 Financial Plan in Place and Number of Endemic Species

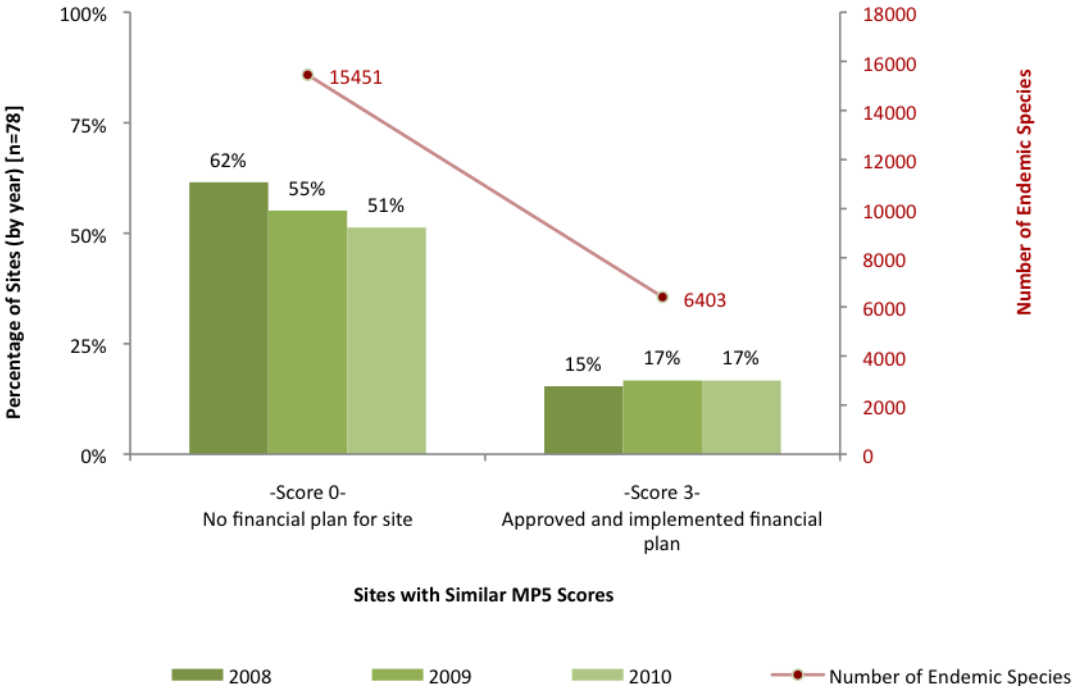


Figure 11.10 Financial Plan in Place and Employment in Agriculture

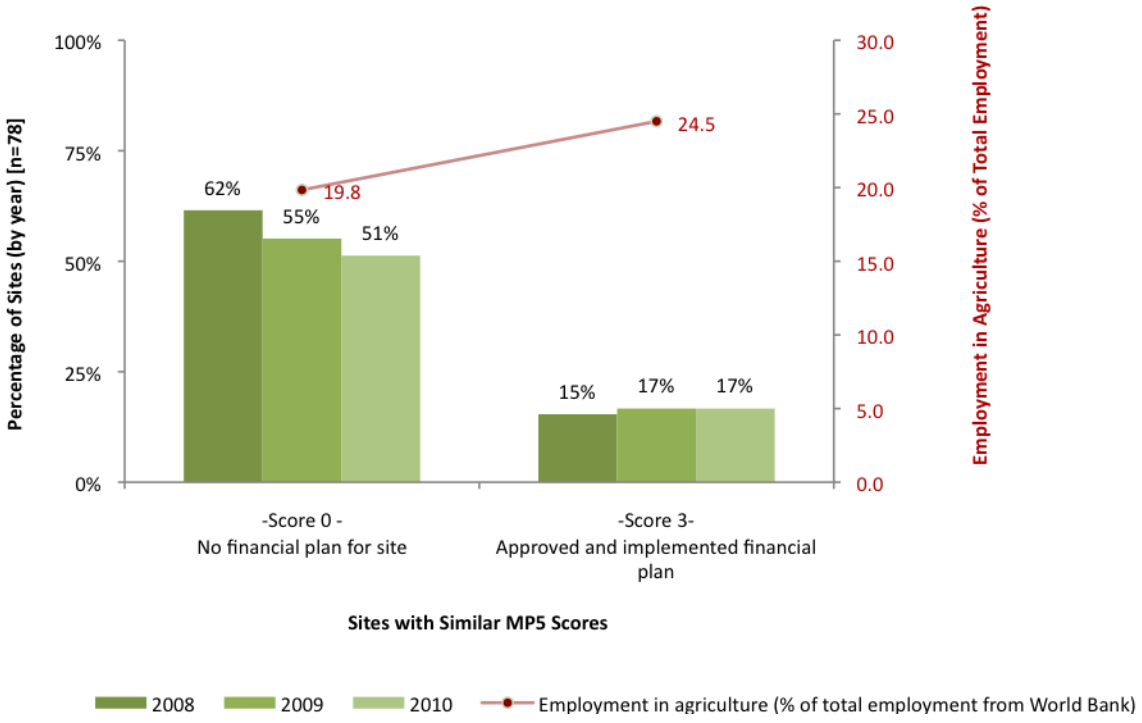


Figure 12.1 Business Plan in Place and Percentage of Population Urbanized

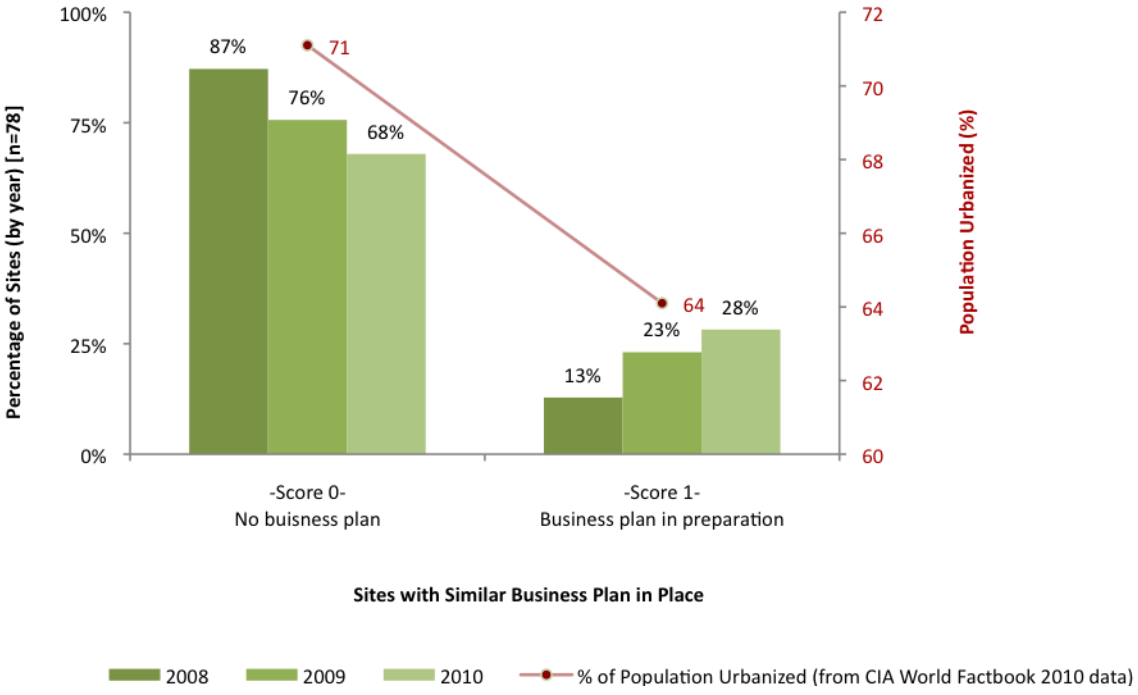


Figure 12.2 Business Plan in Place and HDI Scores

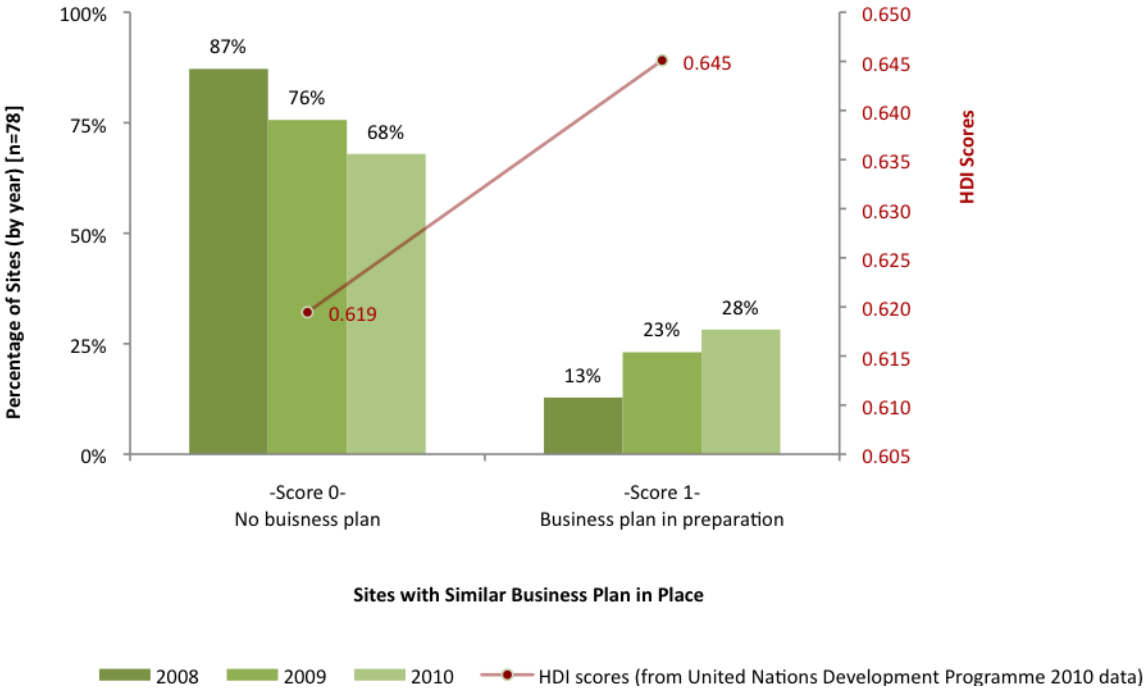


Figure 12.3 Business Plan in Place and Urbanization Rate

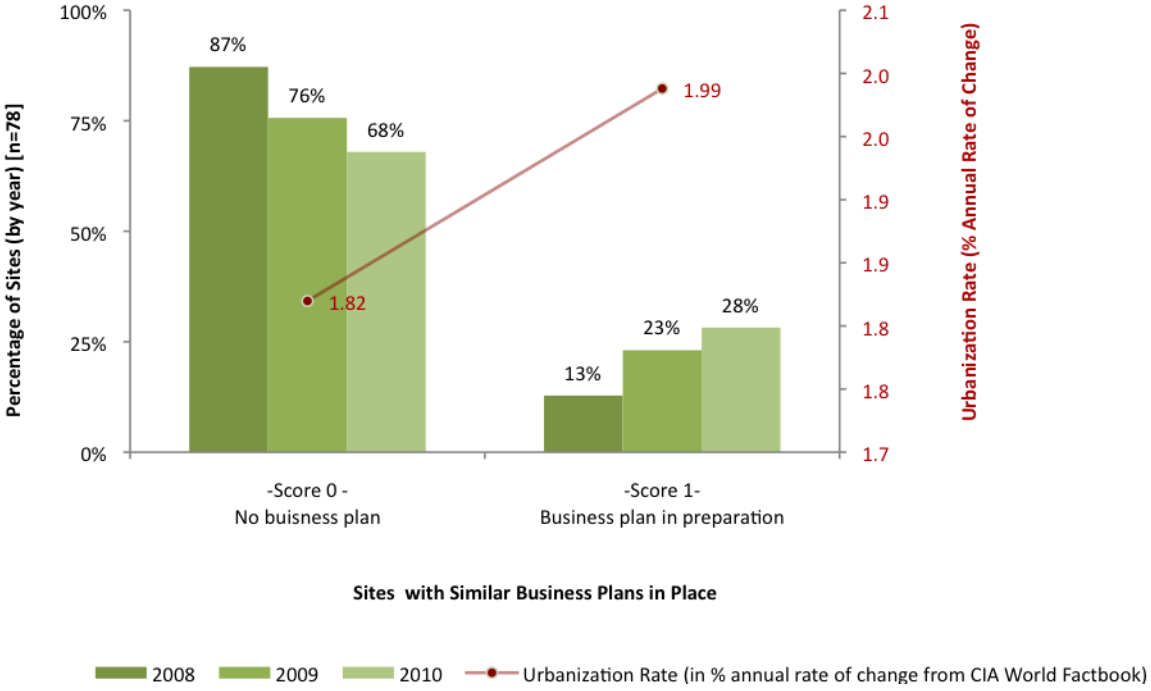


Figure 12.4 Business Plan in Place and GNI per Capita

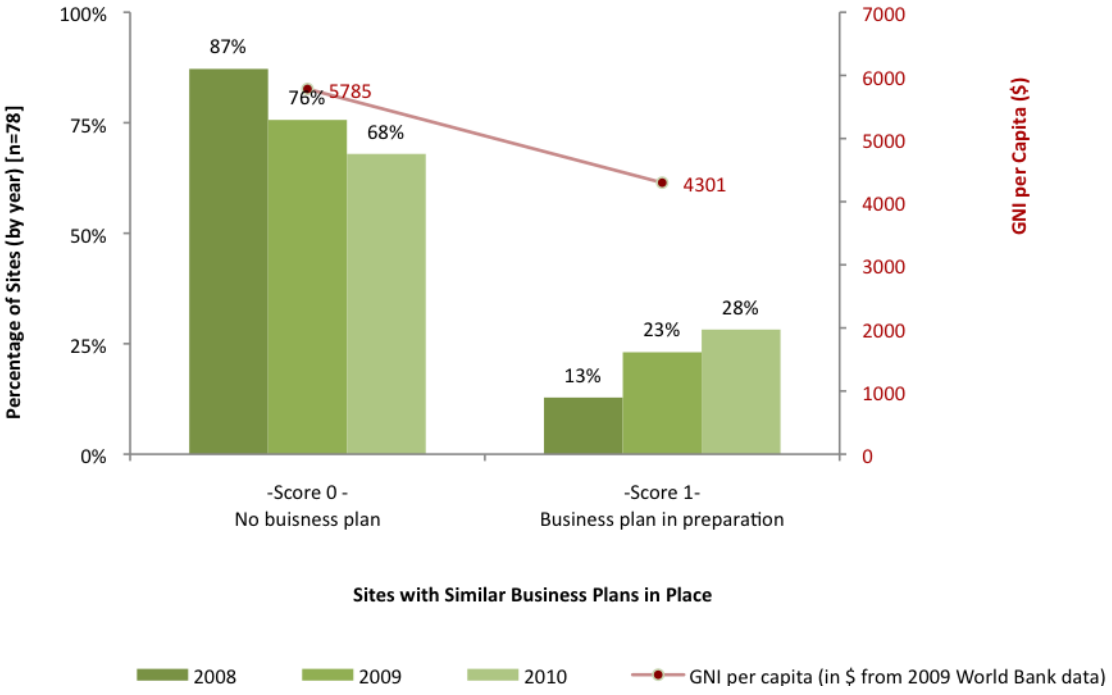


Figure 12.5 Business Plan in Place and Education Levels: Education Expenditures

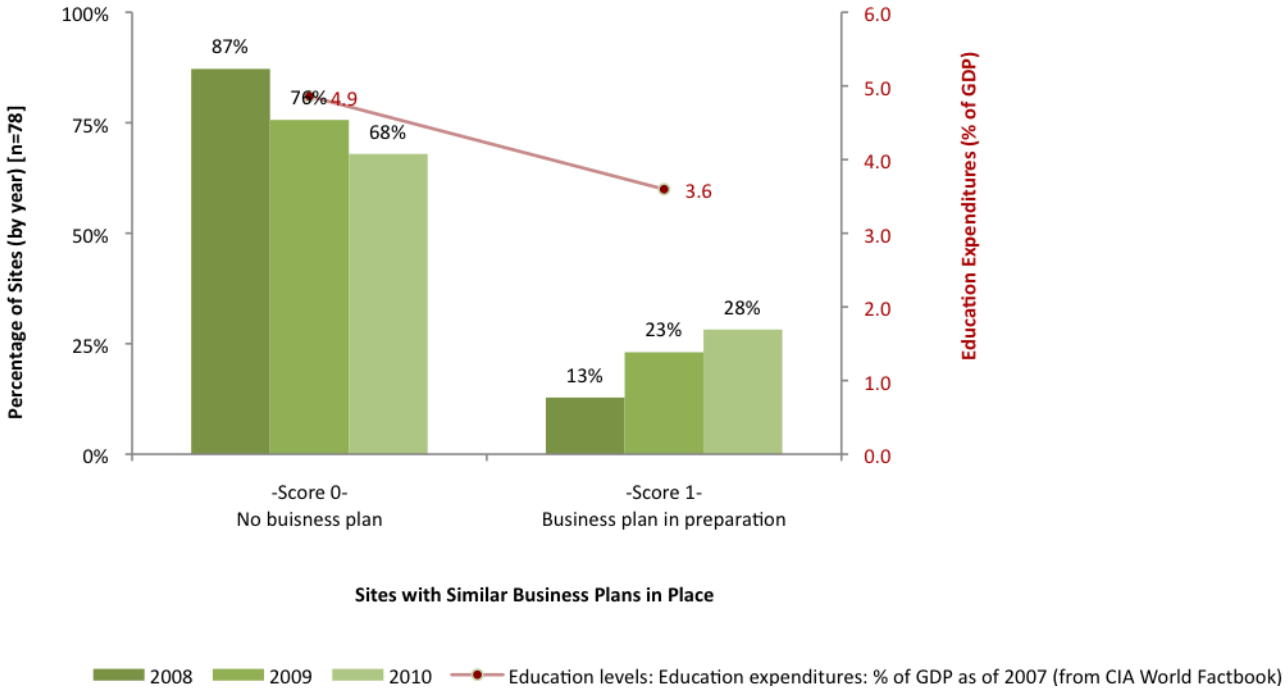


Figure 12.6 Business Plan in Place and Education Expenditures (Country Comparison)

Figure 12.7 Business Plan in Place and Number of Endemic Species

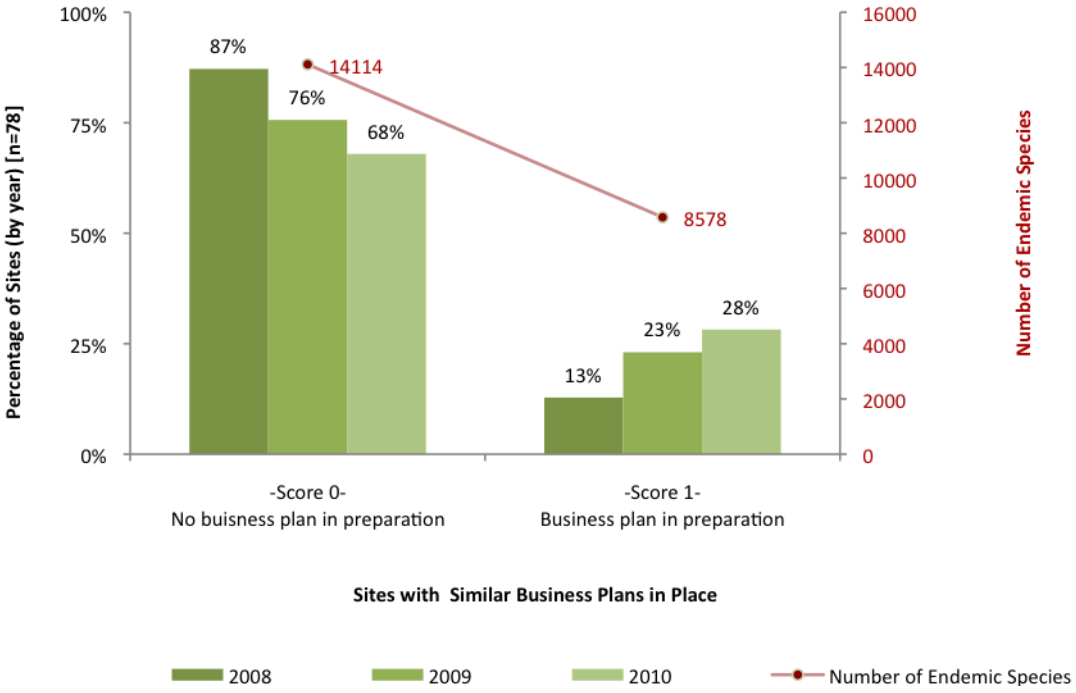


Figure 12.8 Business Plan in Place and Number of "Higher" Threatened Plant Species

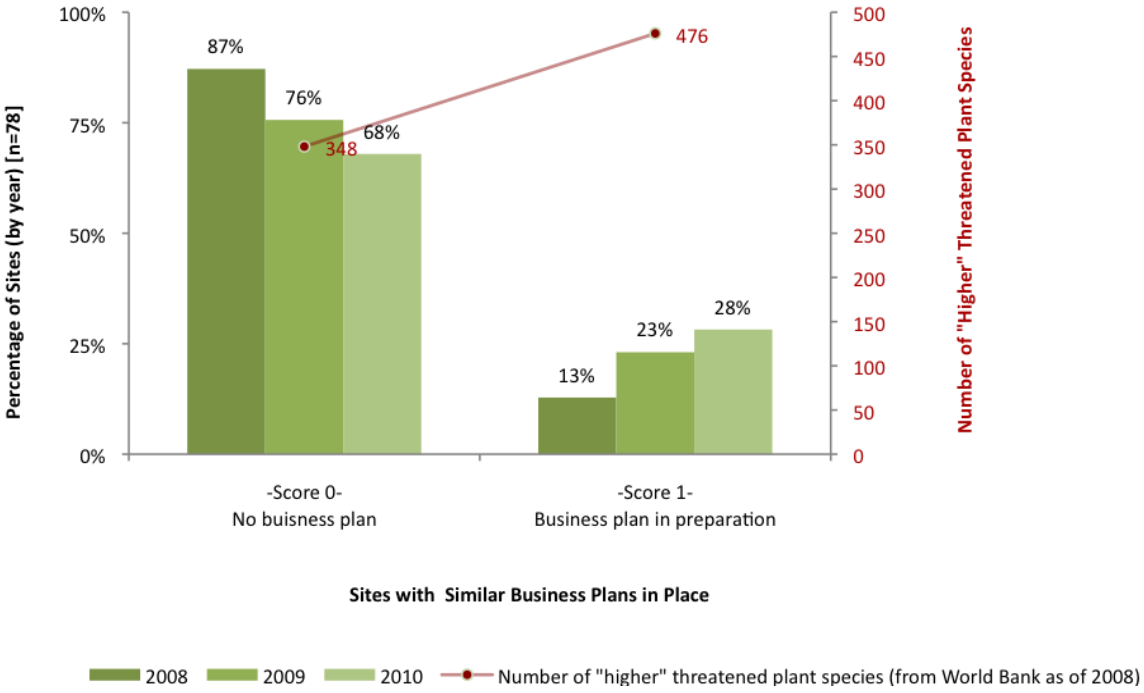
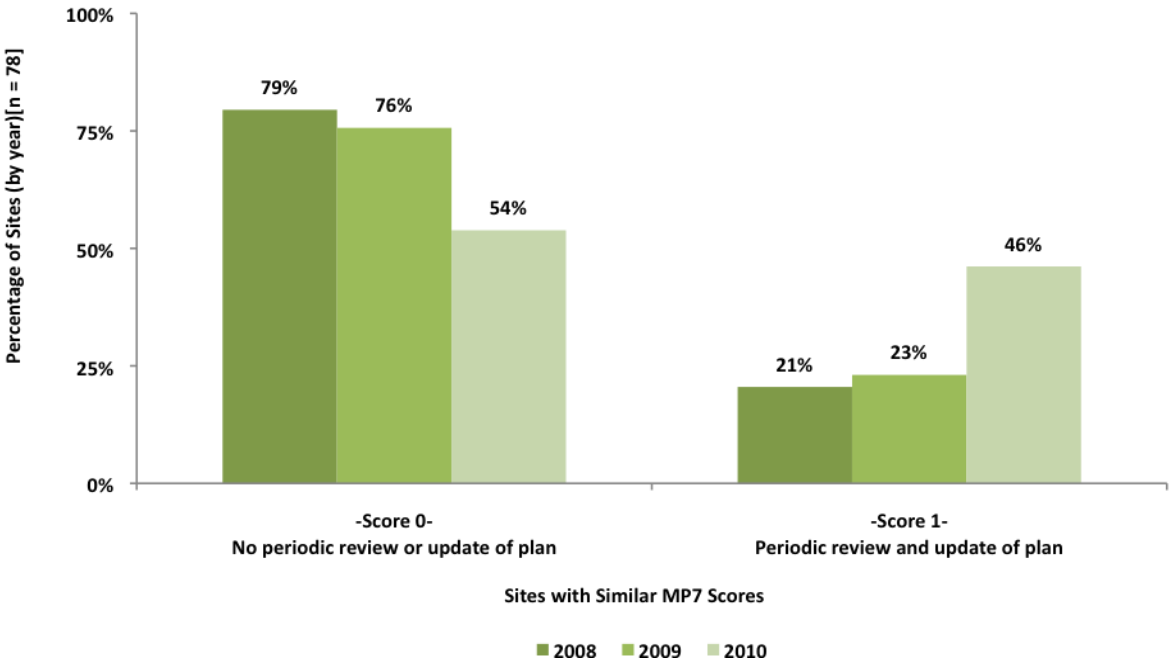
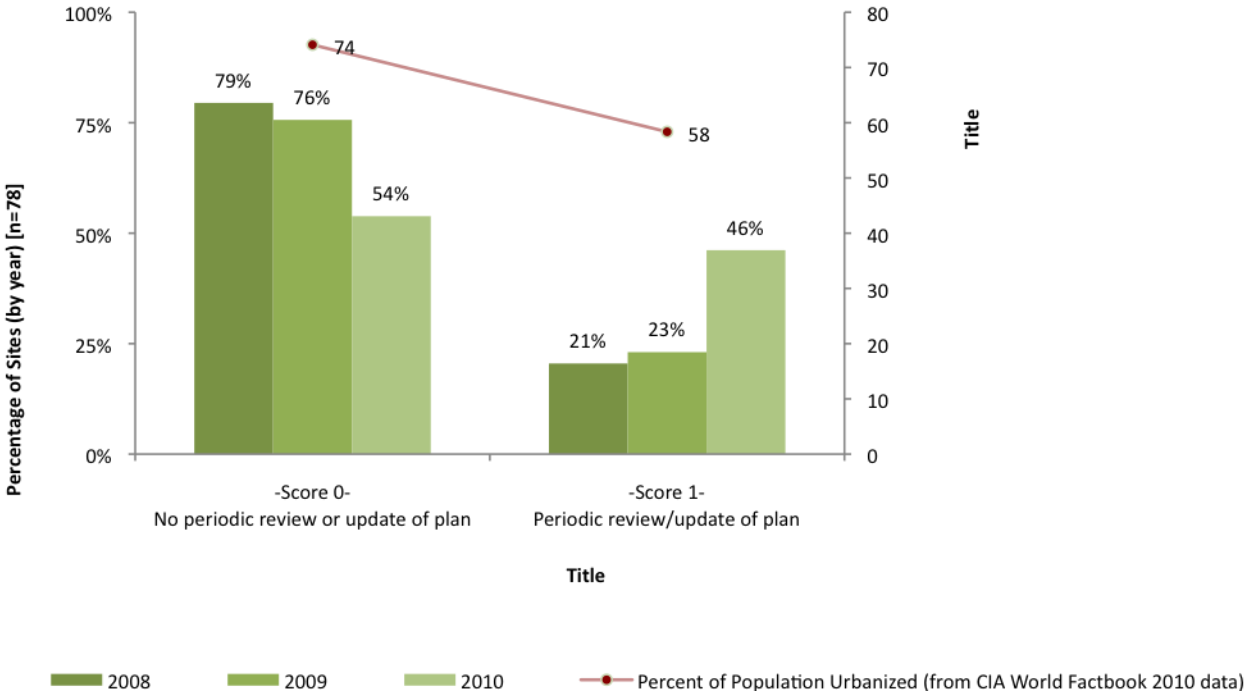


Figure 13.1 Periodic Review and Update of Management Plan



13.2 Periodic Review of Management Plan and Percent of Population Urbanized



13.3 Periodic Review of Management Plan and Urbanization Rate

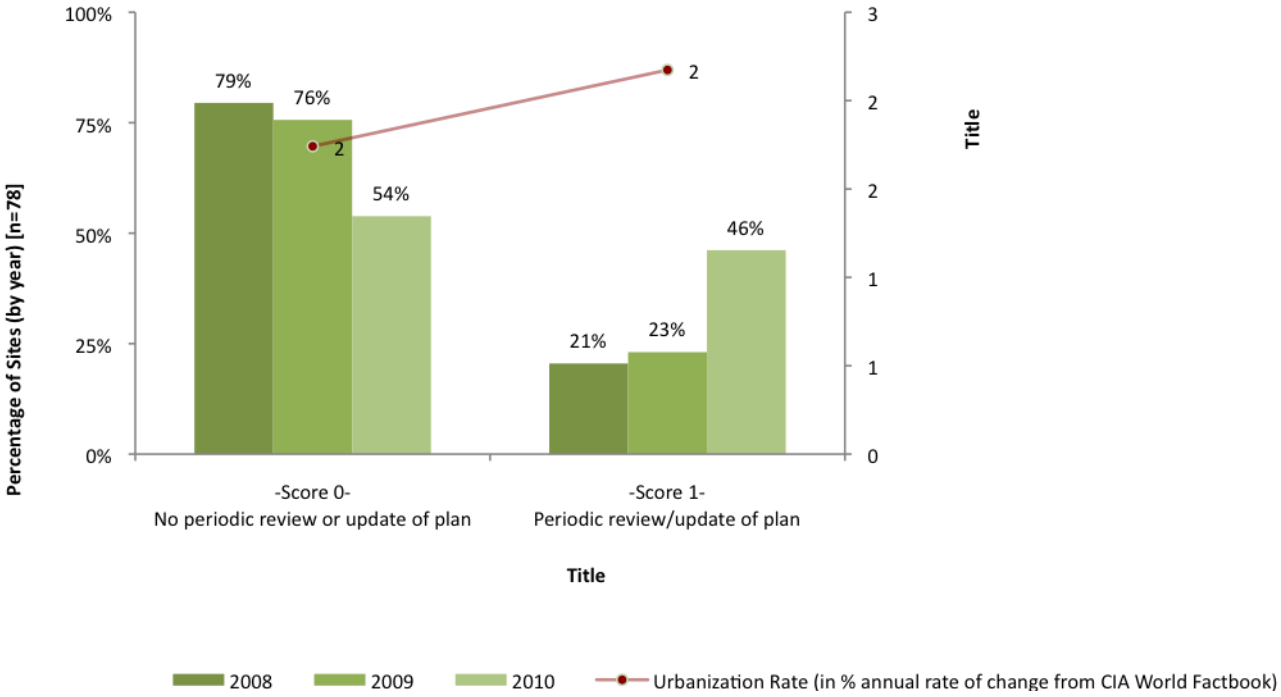


Figure 13.4 Periodic Review of Management Plan and Population Density

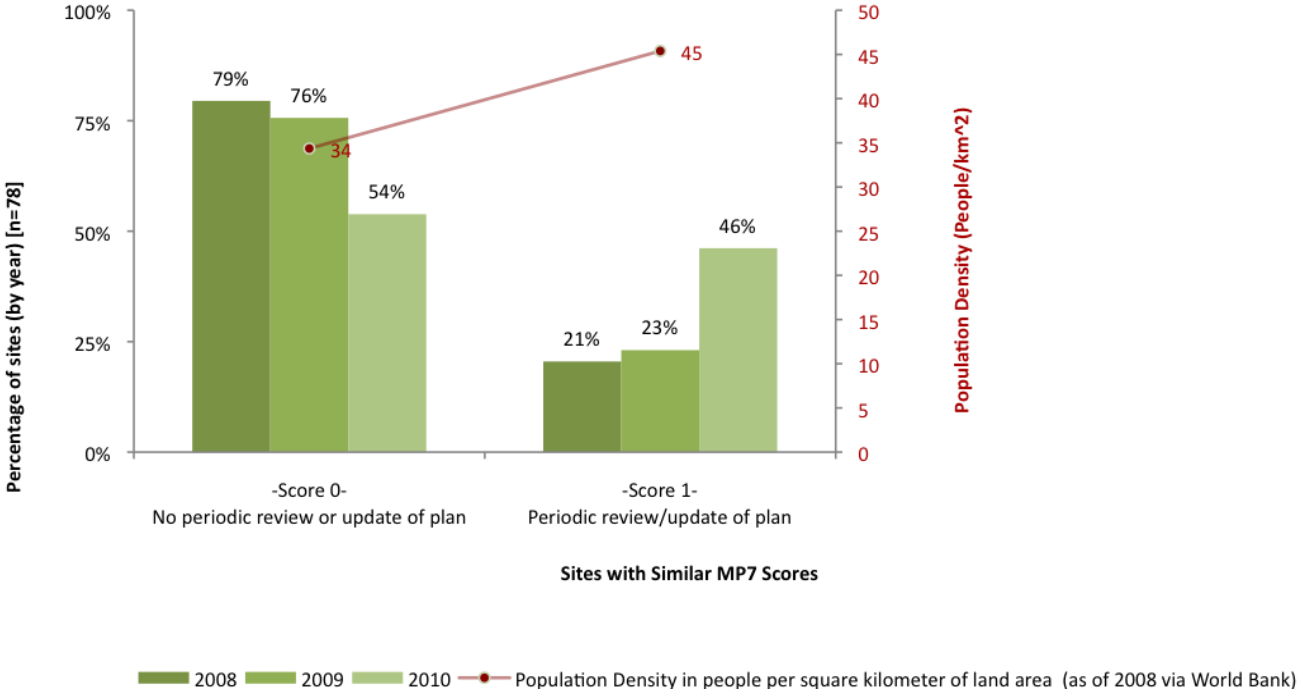


Figure 13.5 Periodic Review of Management Plan and HDI Scores

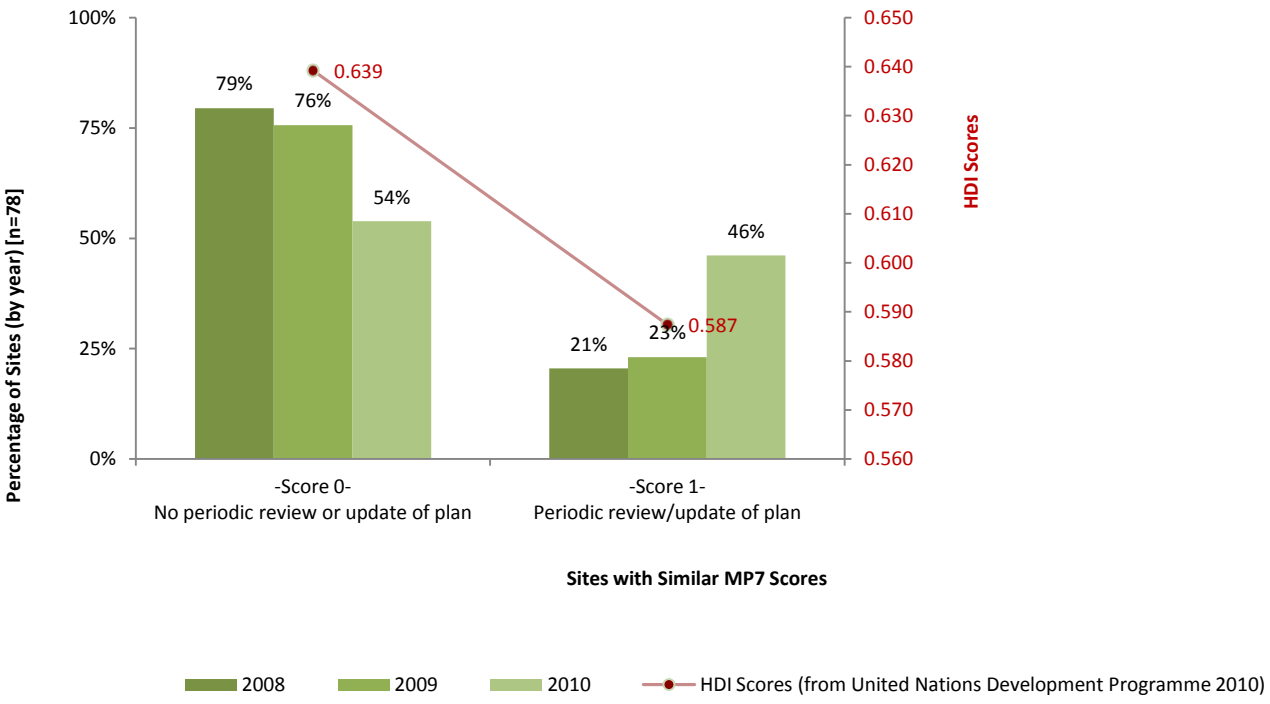


Figure 13.6 Periodic Review of Management Plan and GNI per Capita

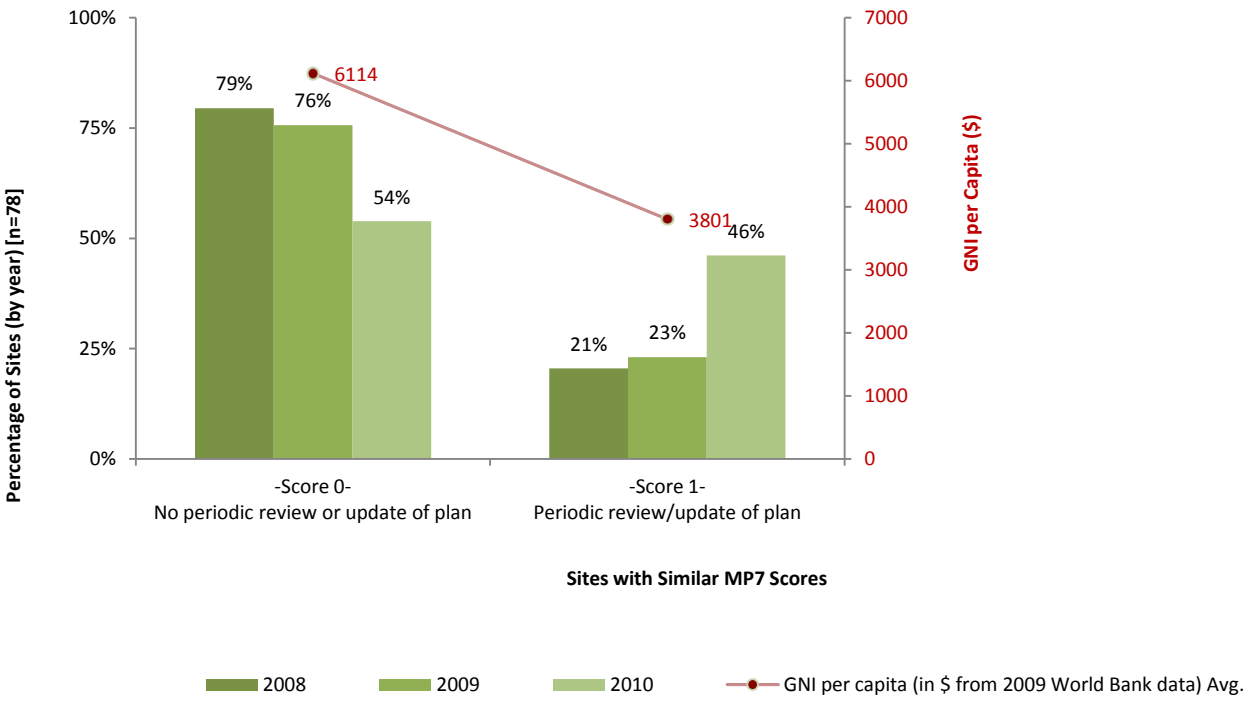


Figure 13.7 Periodic Review of Management Plan and Education Levels

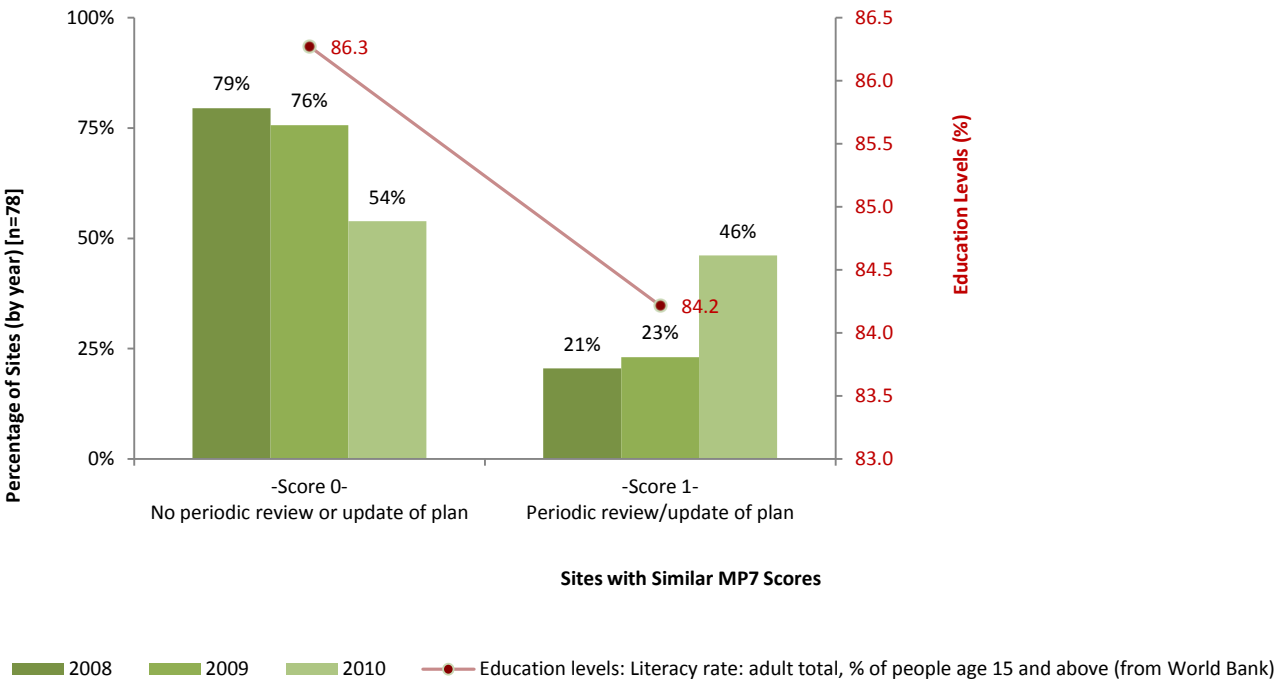


Figure 13.8 Periodic Review of Management Plan and Number of Endemic Species

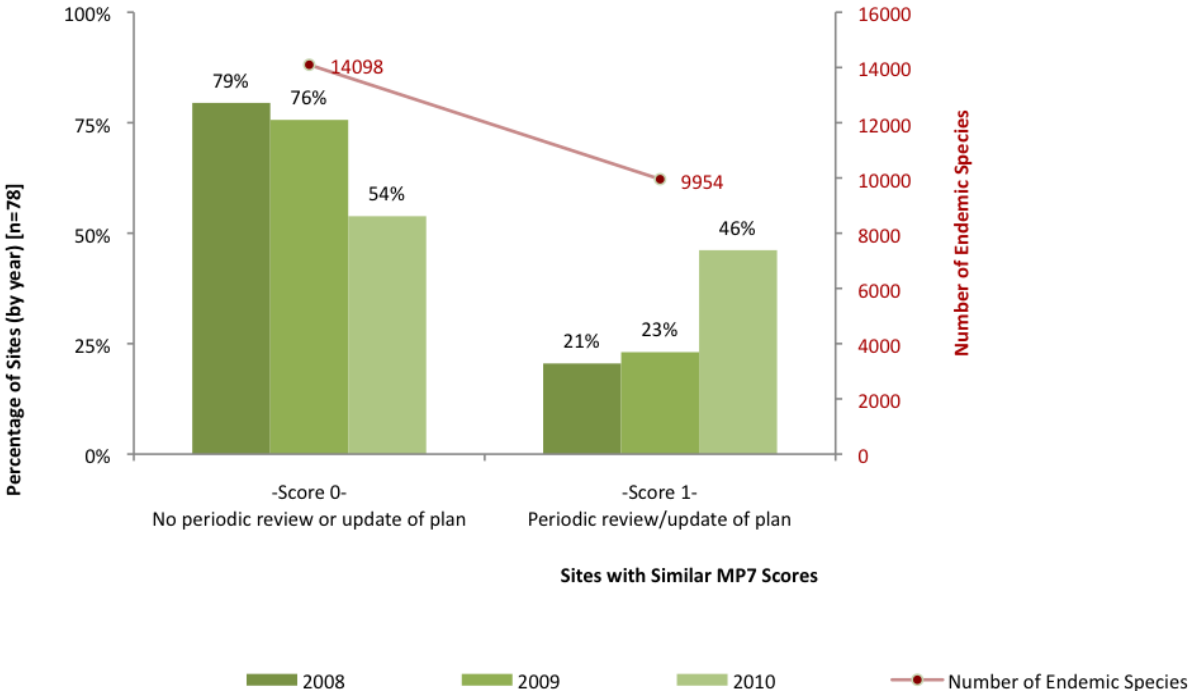


Figure 13.9 Periodic Review of Management Plan and Number of Highly Threatened Plant Species

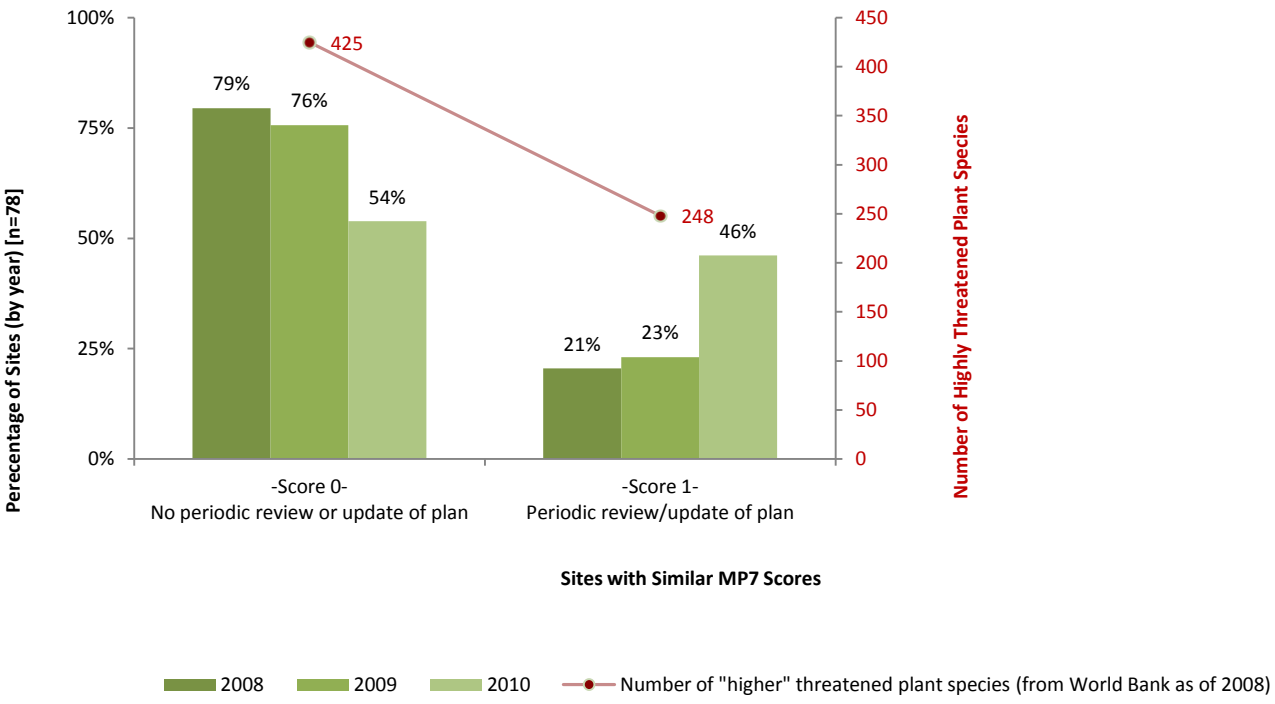


Figure 13.10 Periodic Review of Management Plan and Employment in Agriculture

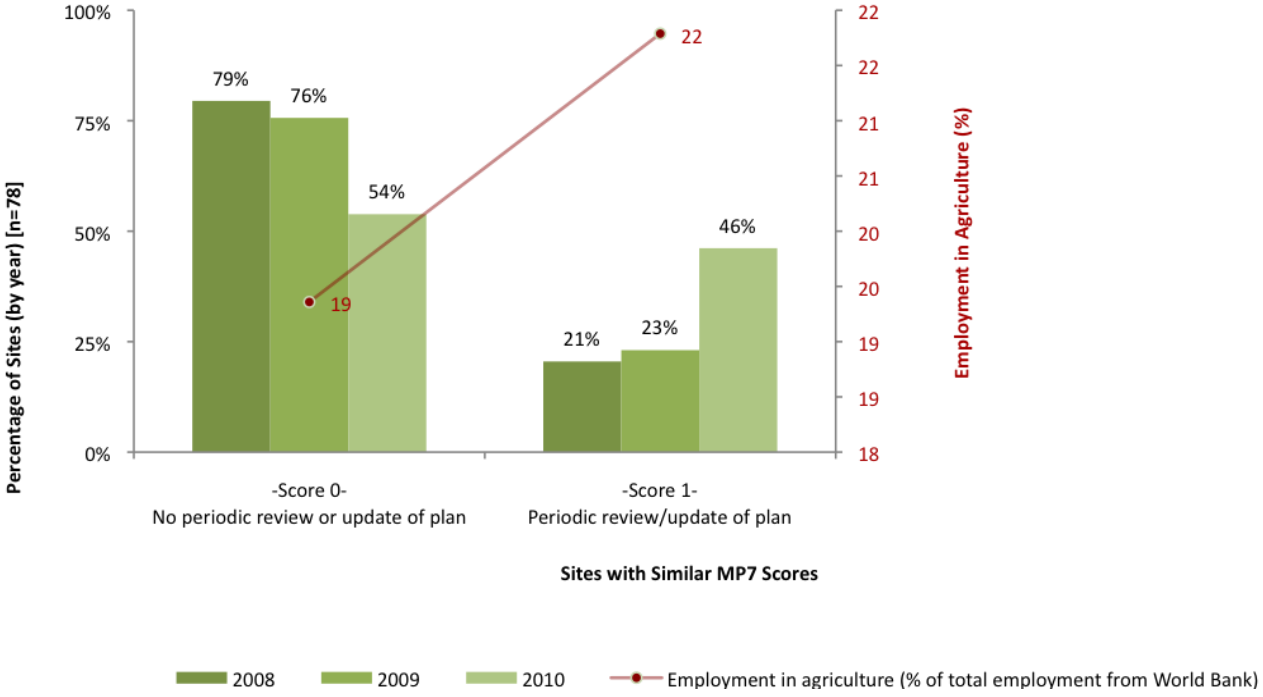


Figure 14.1 Biodiversity Targets Identified

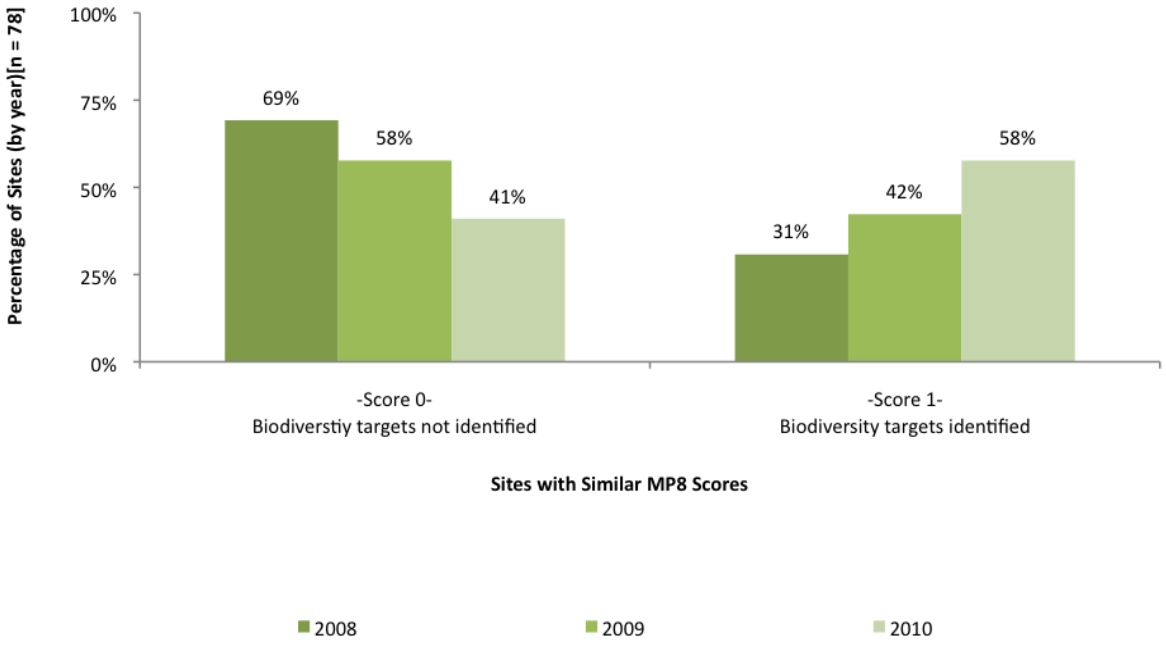


Figure 14.2 Biodiversity Targets and Population Density

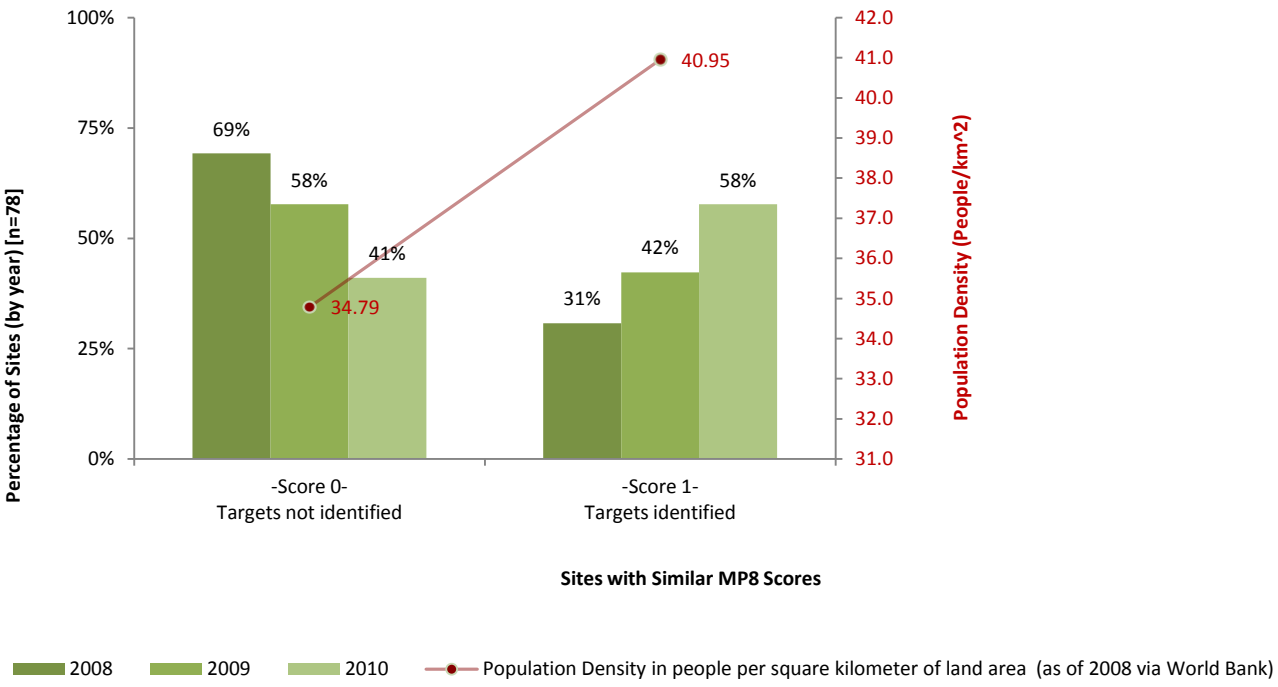


Figure 14.3 Biodiversity Targets and Percent of Population Urbanized

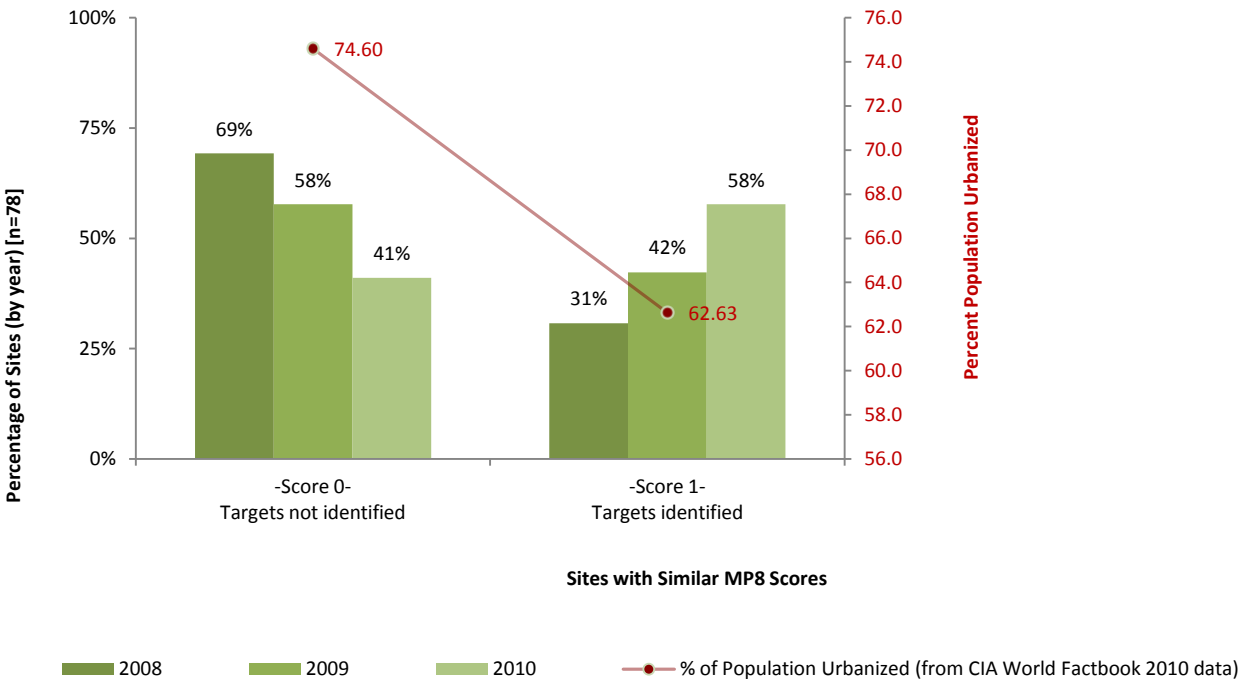


Figure 14.4 Biodiversity Targets and Urbanization Rate

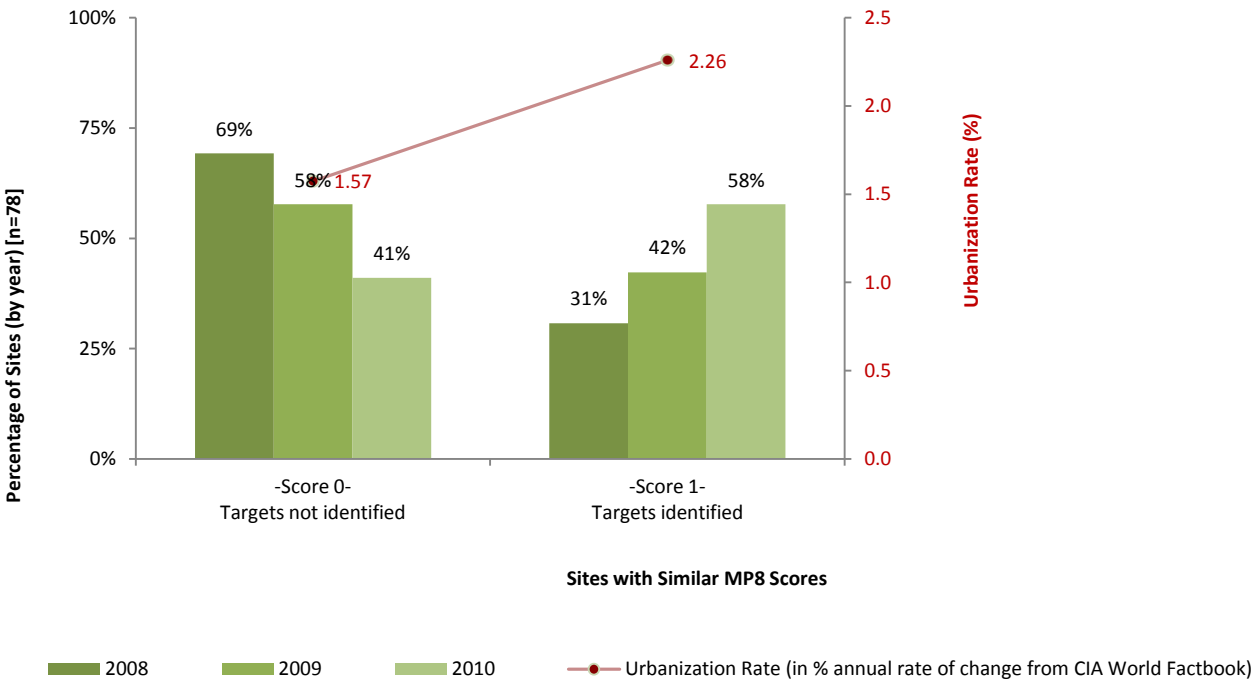


Figure 14.5 Biodiversity Targets and Population Growth Rates

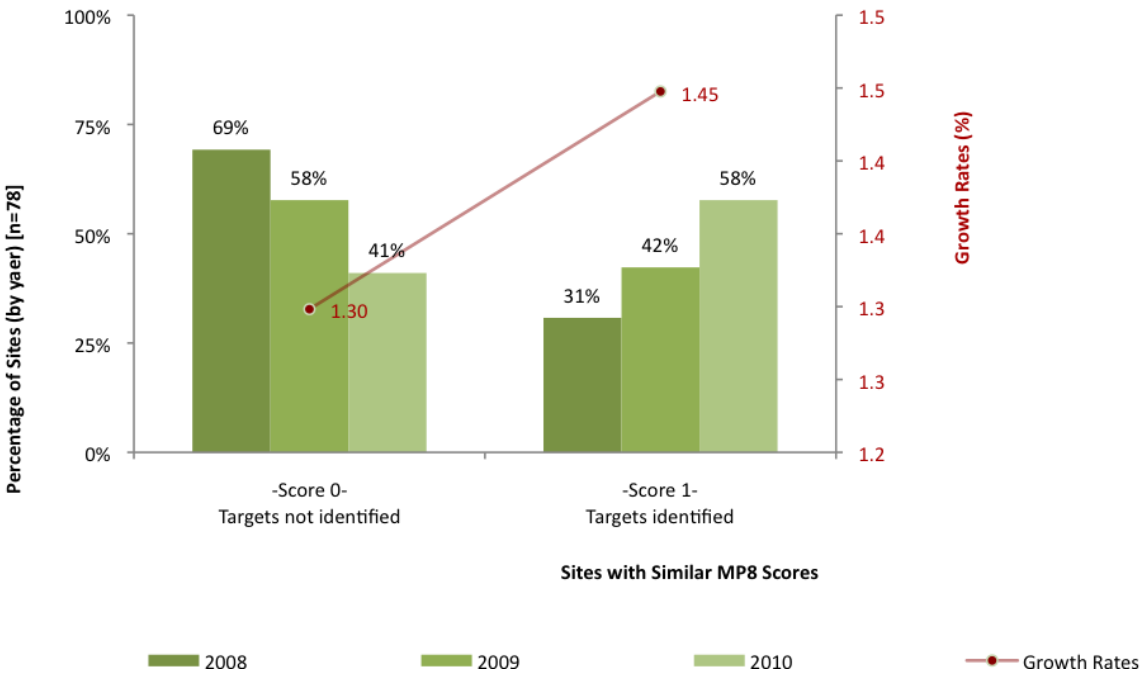


Figure 14.6 Biodiversity Targets and HDI Scores

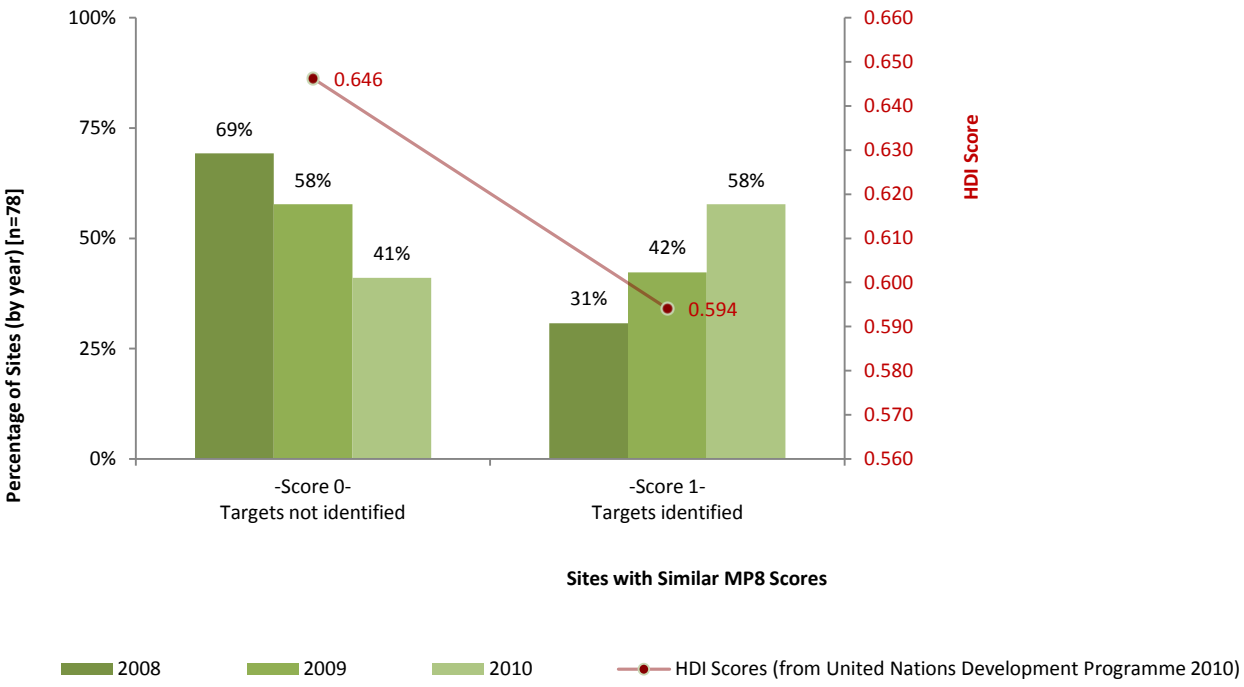


Figure 14.7 Biodiversity Targets and GNI per Capita

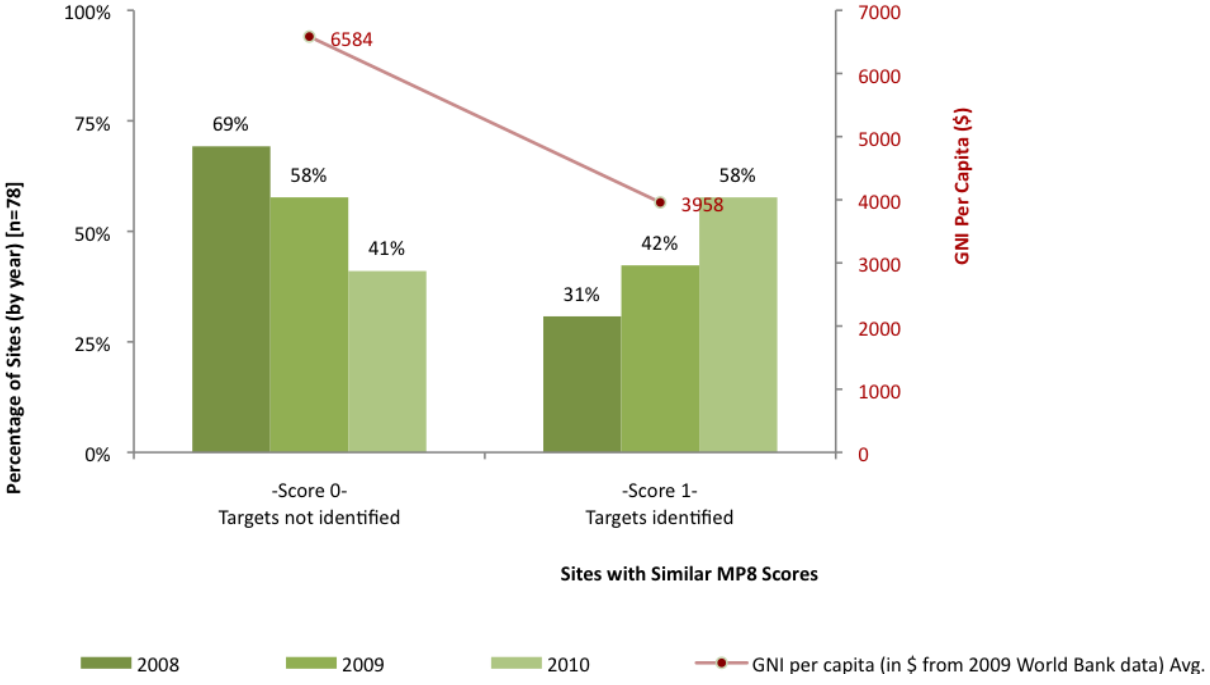


Figure 14.8 Biodiversity Targets and Education Levels

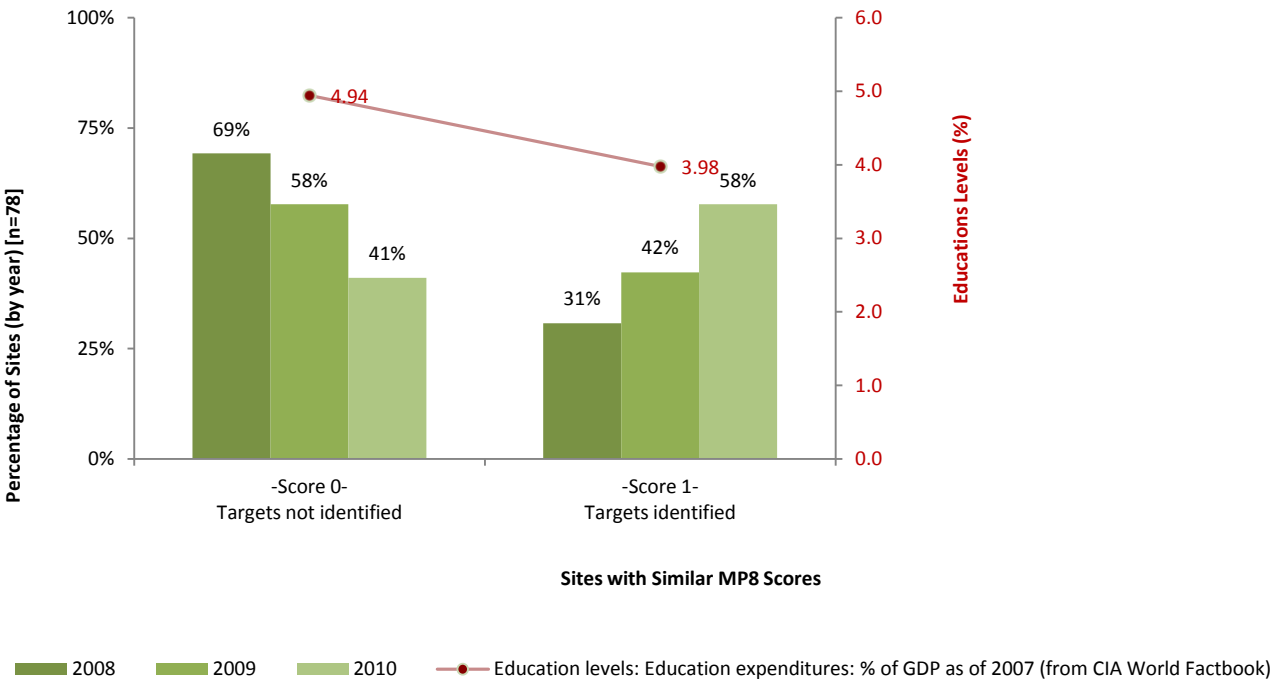


Figure 14.9 Biodiversity Targets and Education Expenditures

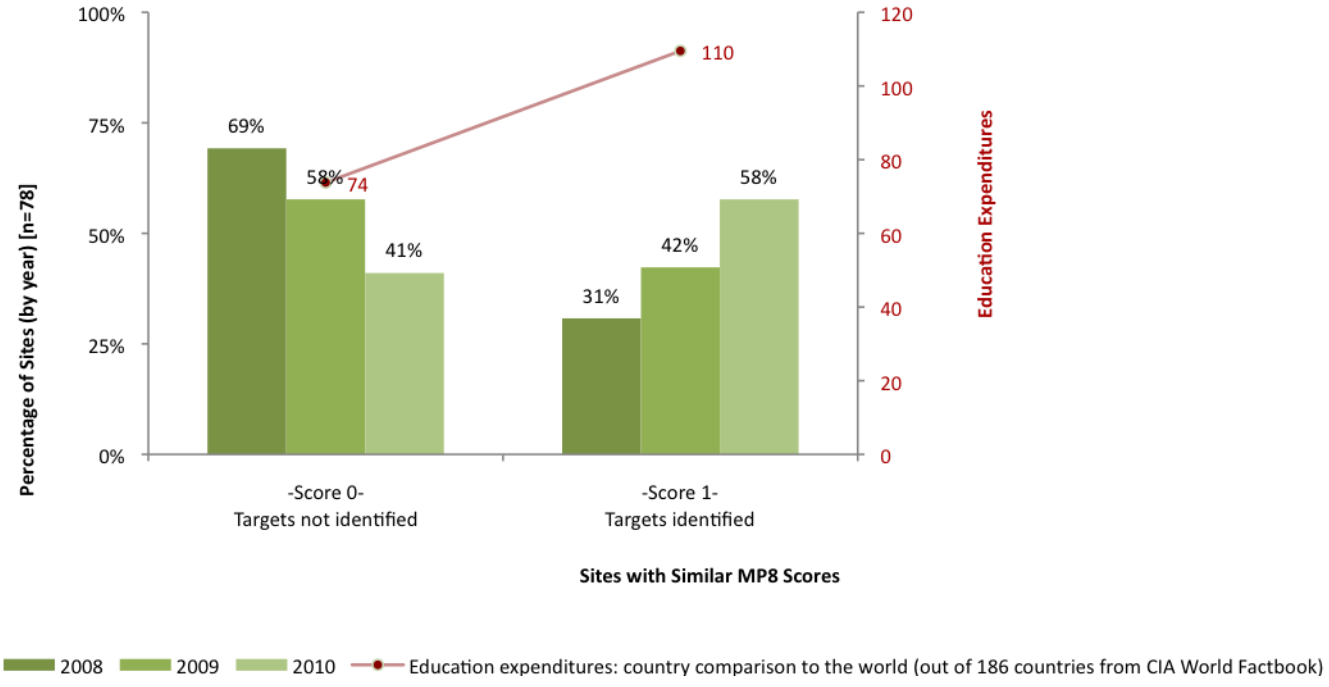


Figure 14.10 Biodiversity Targets and Number of Endemic Species

Figure 14.11 Biodiversity Targets and Number of Higher Threatened Plant Species

Figure 14.12 Biodiversity Targets and Employment in Agriculture

Figure 15.1 **Staffing in Place**

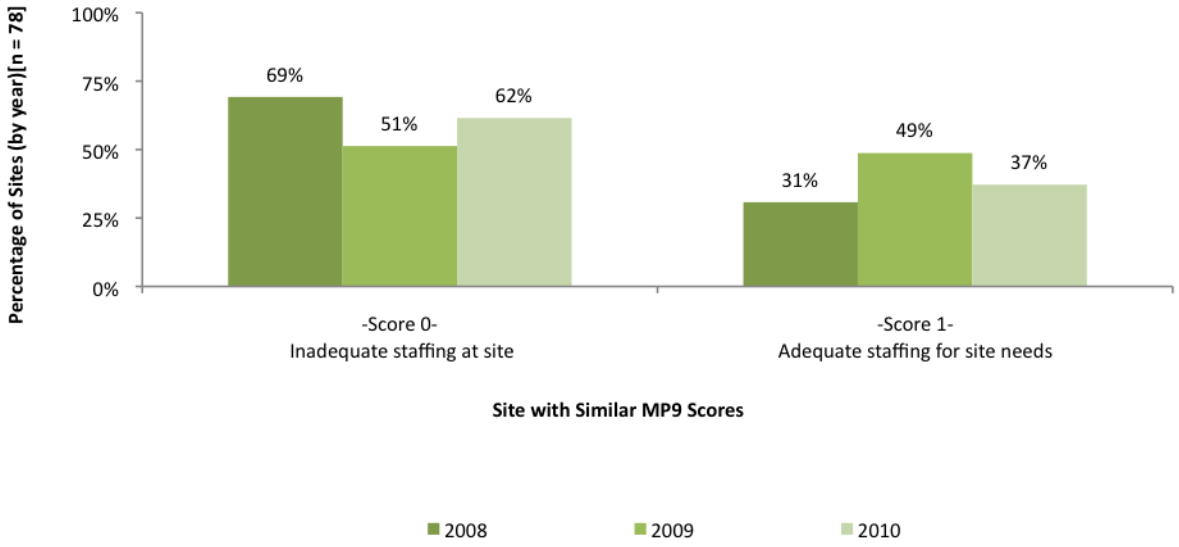


Figure 15.2 Staffing in Place and Population Density

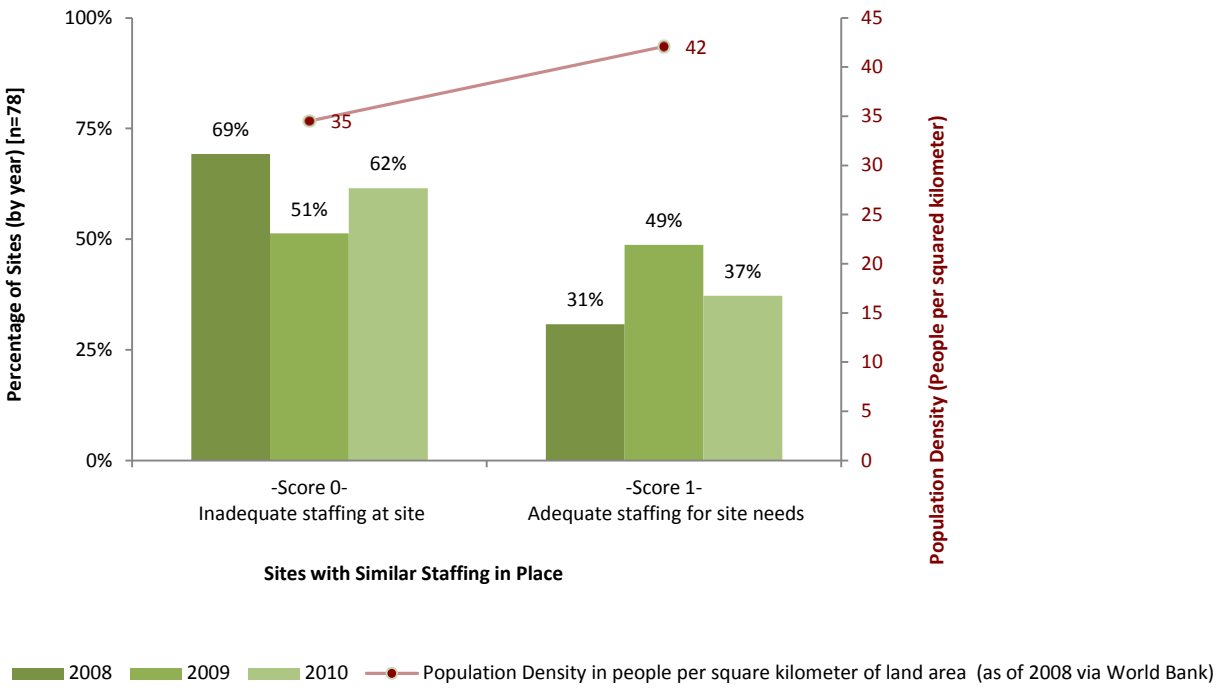


Figure 15.3 Staffing in Place and Urbanization Rate

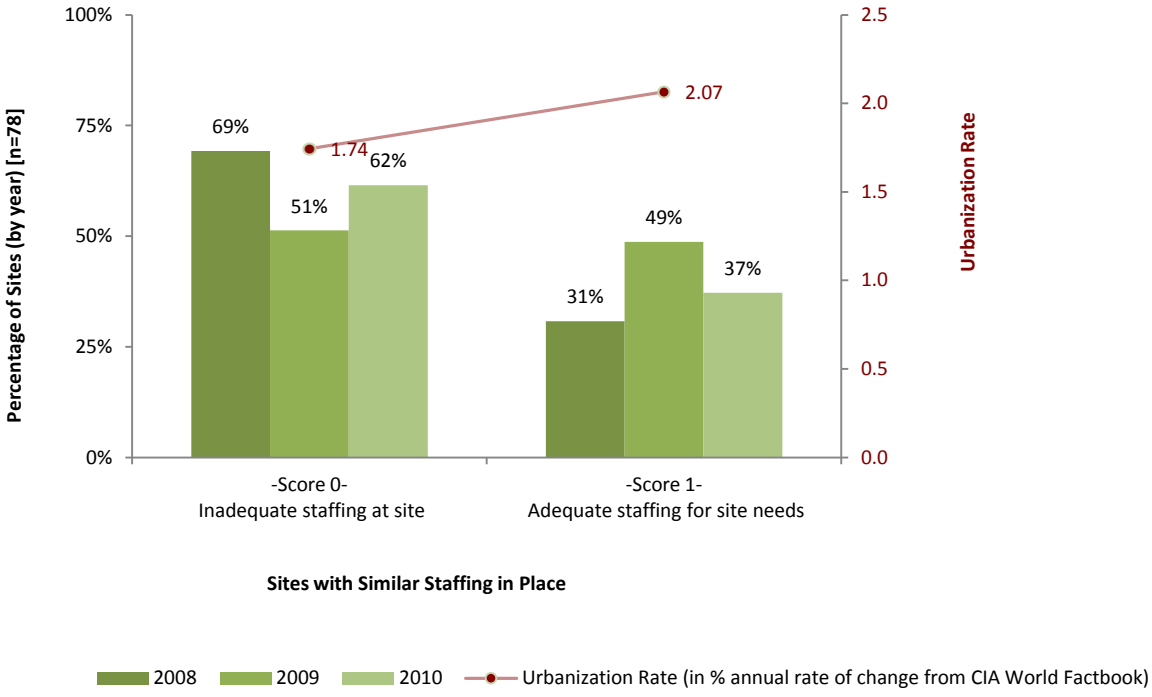


Figure 15.4 Staffing in Place and Population Urbanized

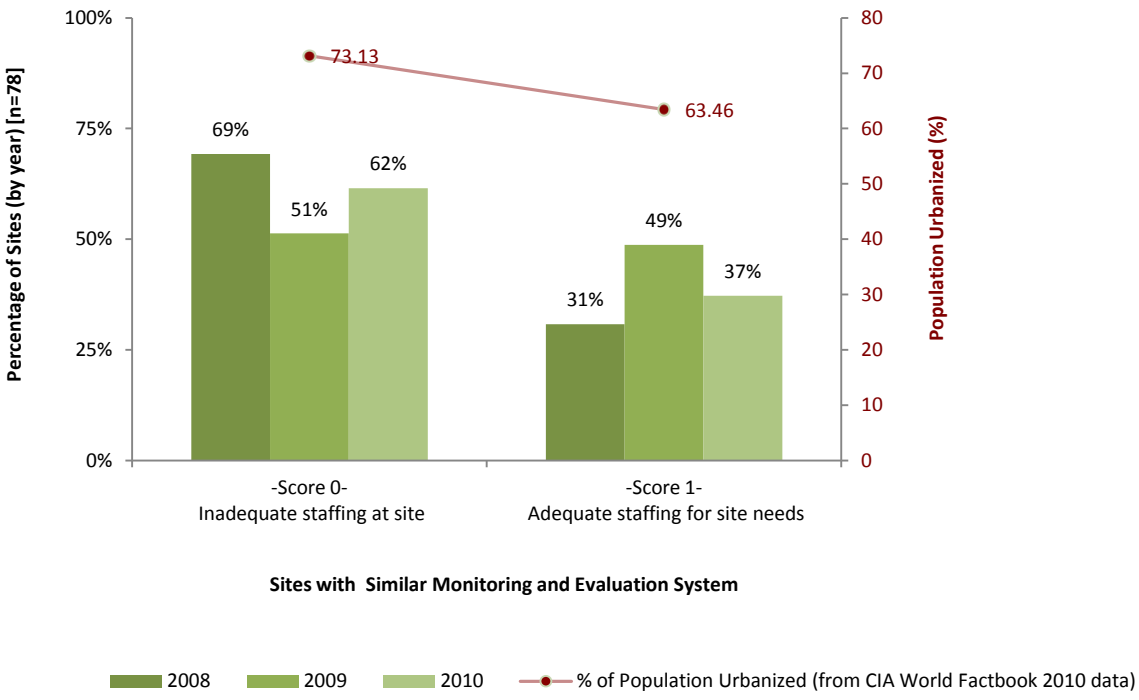


Figure 15.5 Staffing in Place and Gross National Income Per Capita

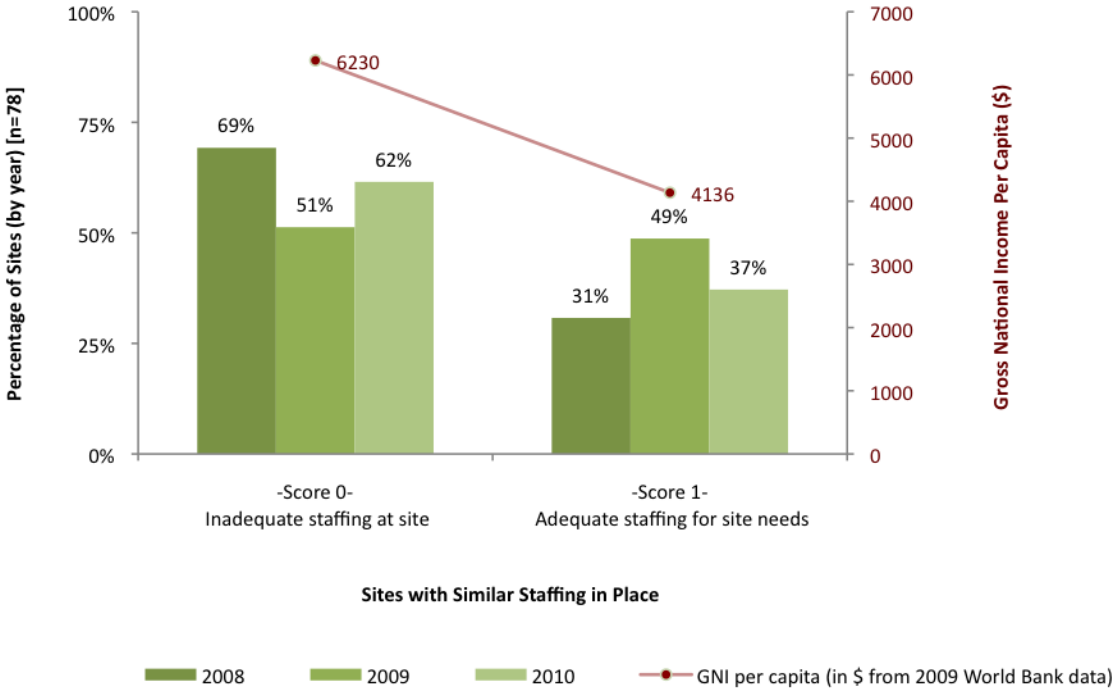


Figure 15.6 Staffing in Place and Education Level: Education Expenditures

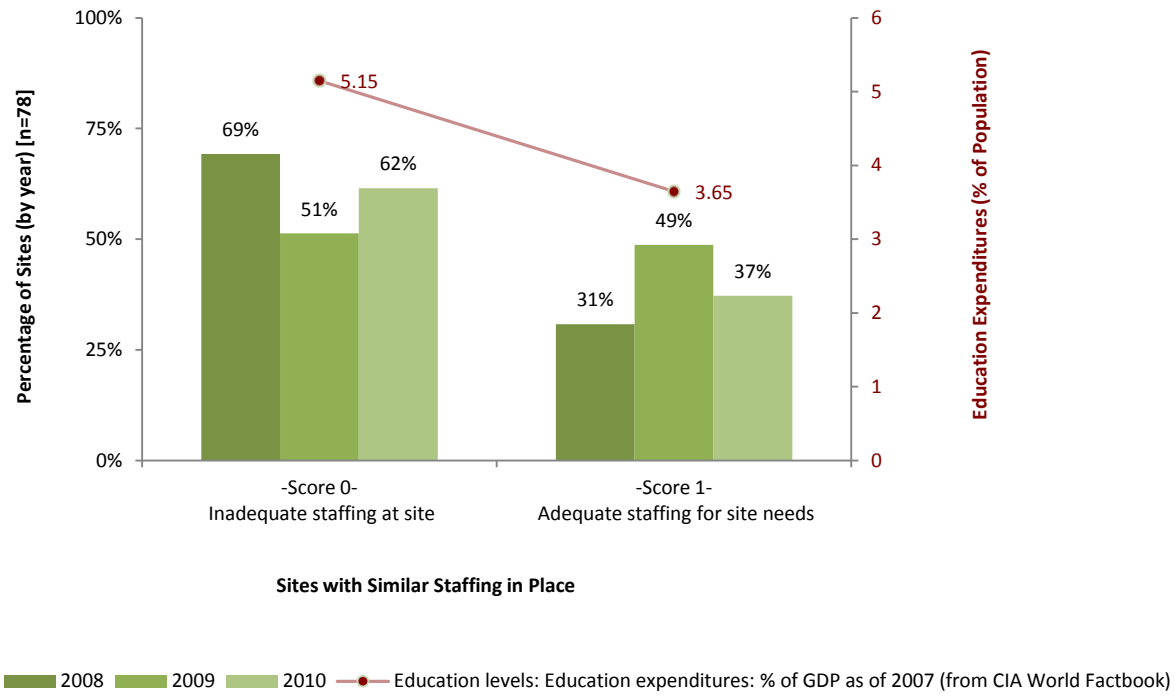


Figure 15.7 Staffing in Place and Education Expenditures

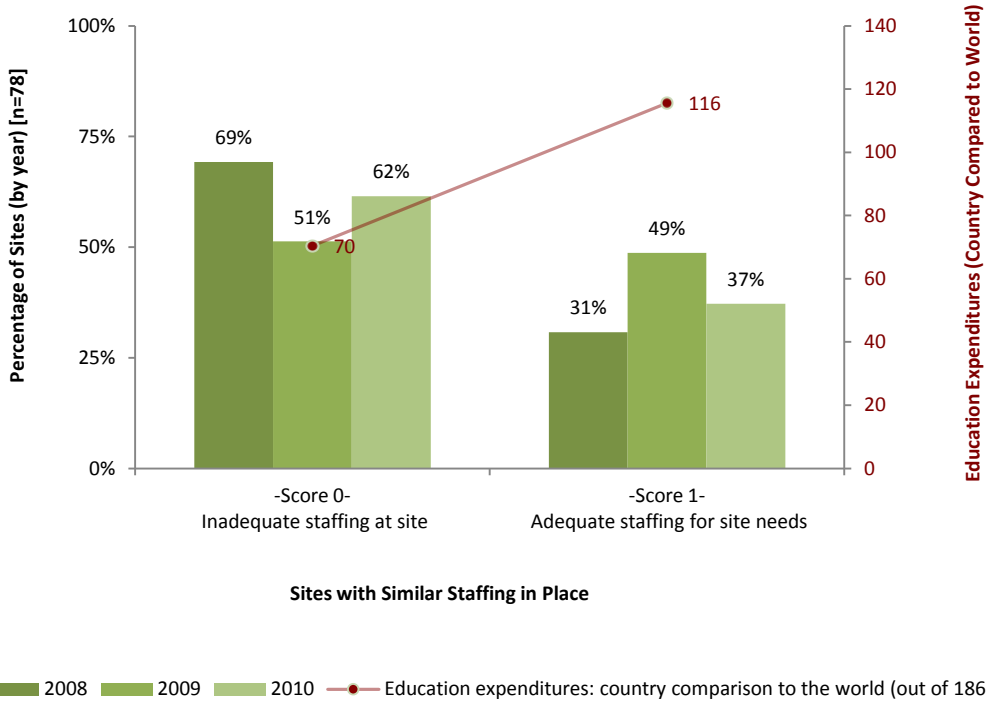


Figure 15.8 Staffing in Place and Number of Endemic Species

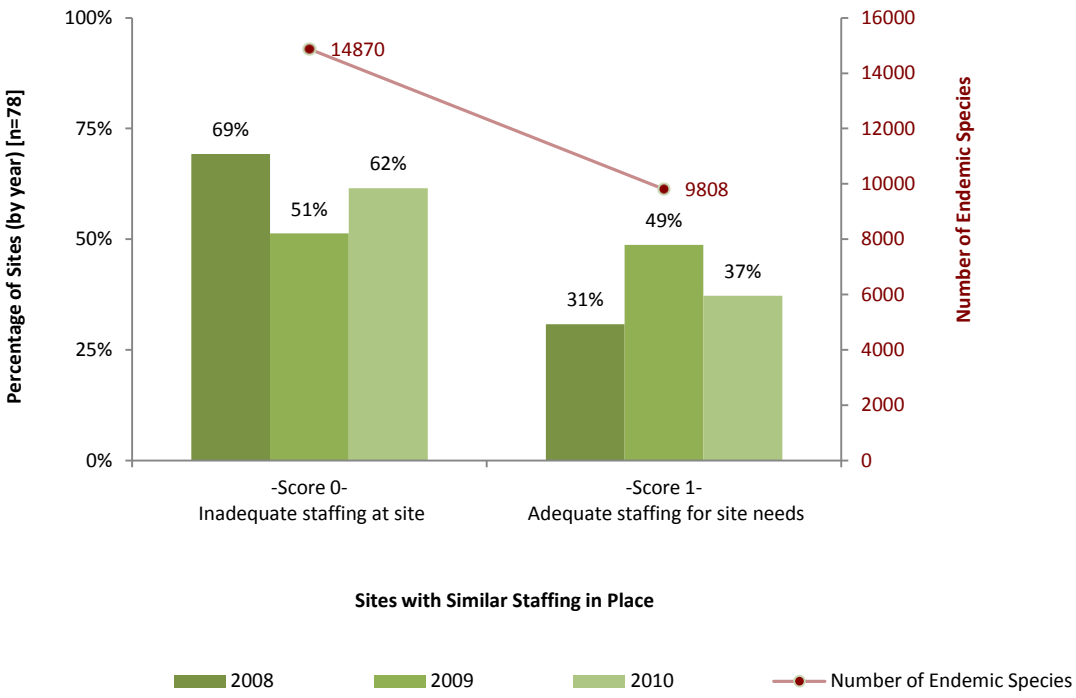


Figure 16.1 Status of Land Tenure Surrounding Communities

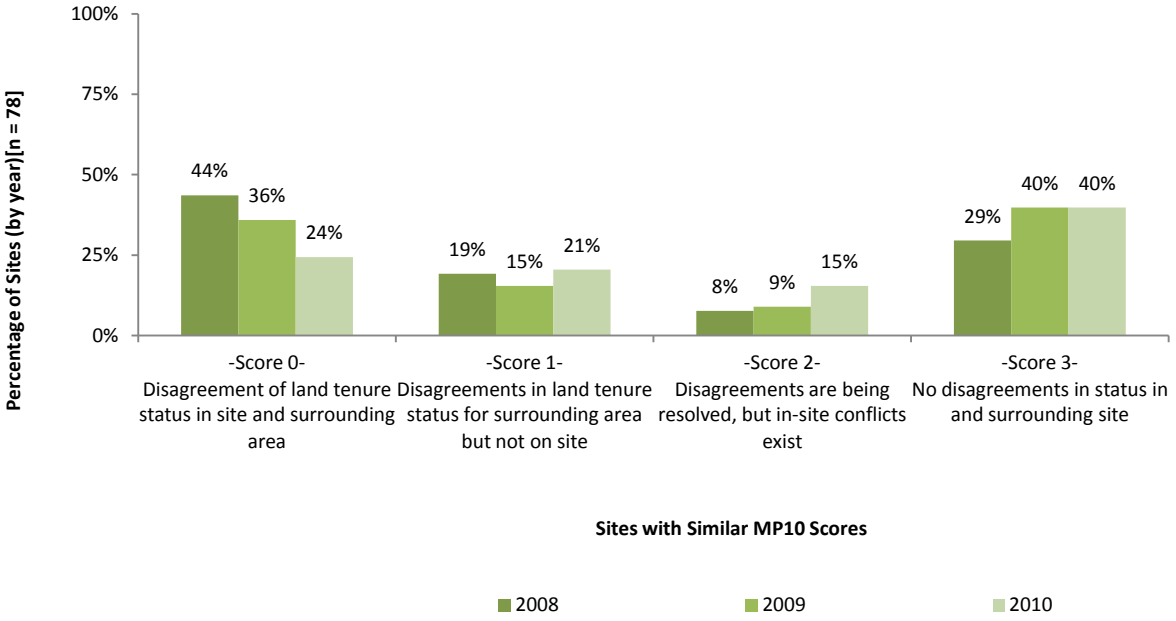


Figure 17.1 Adequate Staff Training and Skills across 78 sites over 3 years

Figure 17.2 Adequate Staff Training and Skills and Percent of Population Urbanized

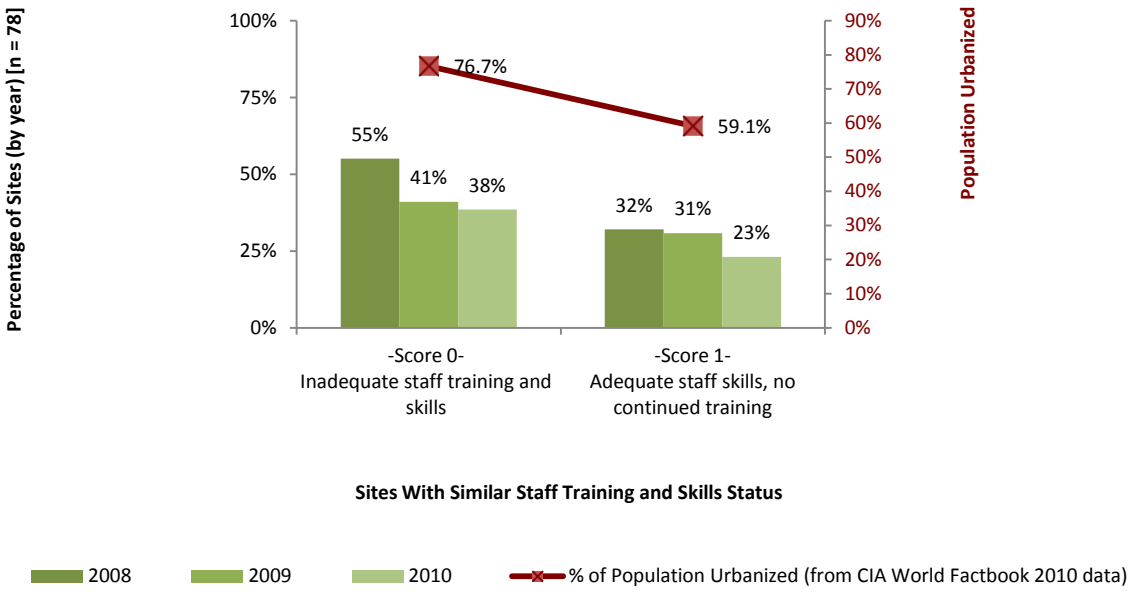


Figure 17.3 Adequate Staff Training and Skills and Urbanization Rate

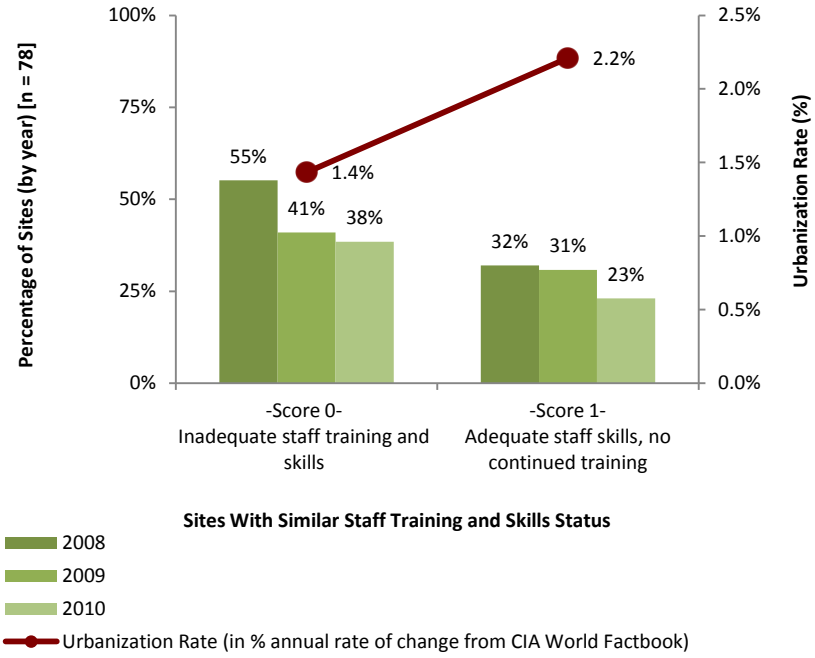


Figure 17.4 Adequate Staff Training and Skills and Population Growth Rates

Figure 17.5 Adequate Staff Training and Skills and HDI Scores

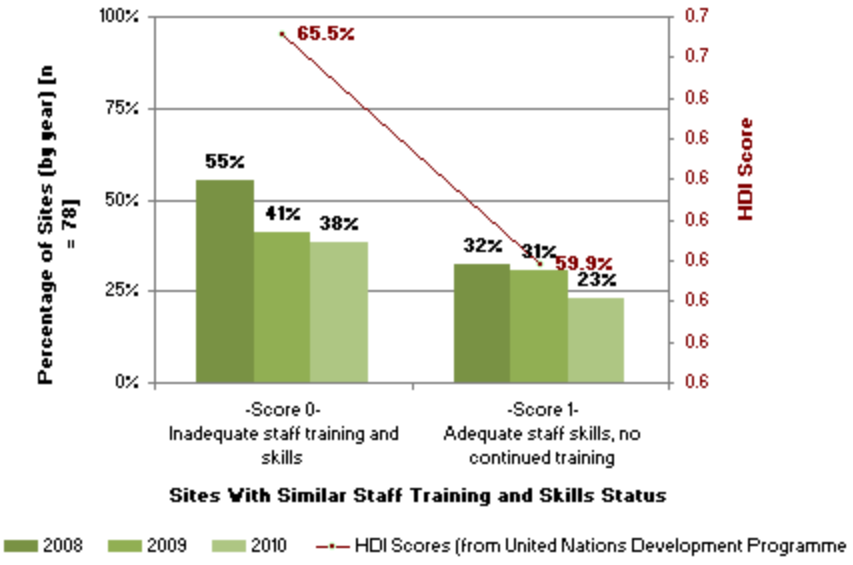


Figure 17.5 Adequate Staff Training and Skills and HDI Scores

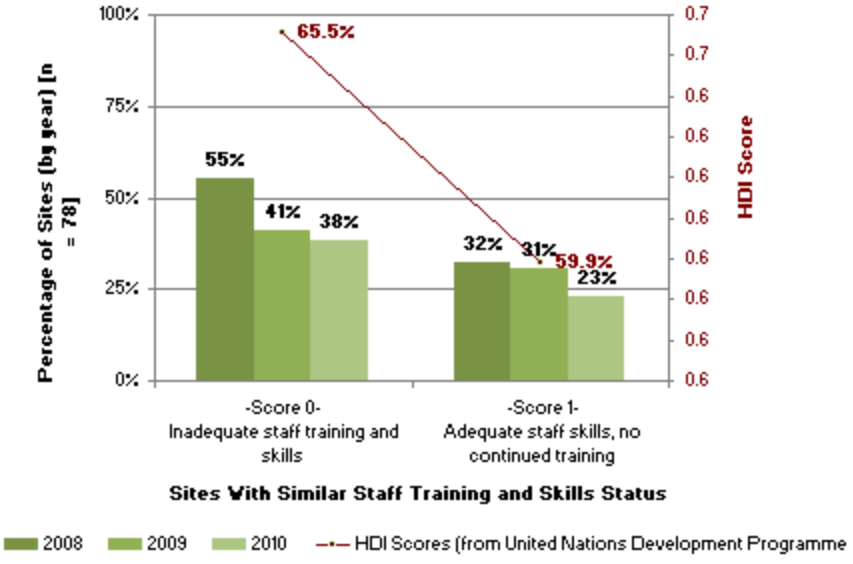


Figure 17.6 Adequate Staff Training and Skills and GNI per Capita

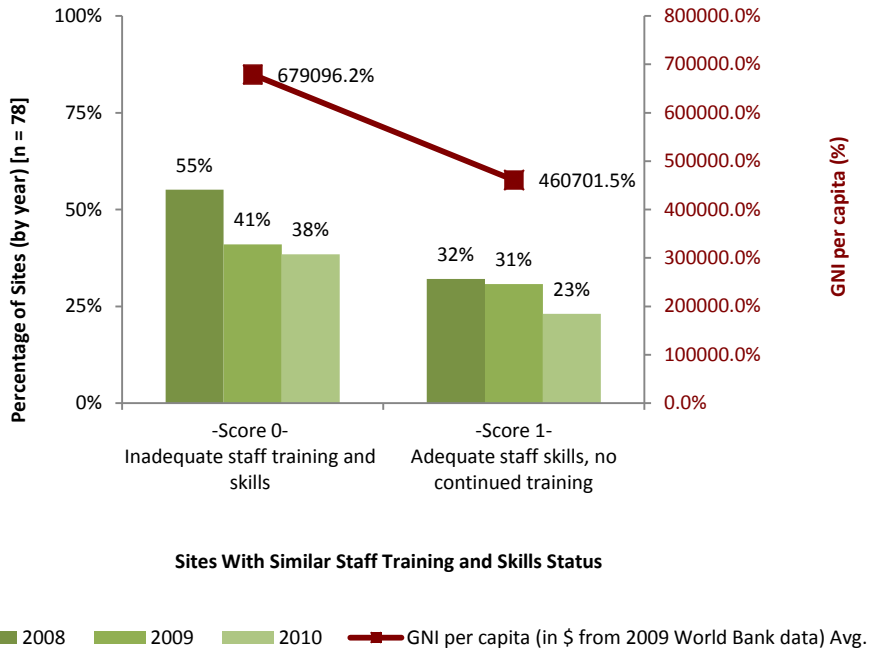


Figure 17.7 Adequate Staff Training and Skills and Education Expenditures: Percent of GDP

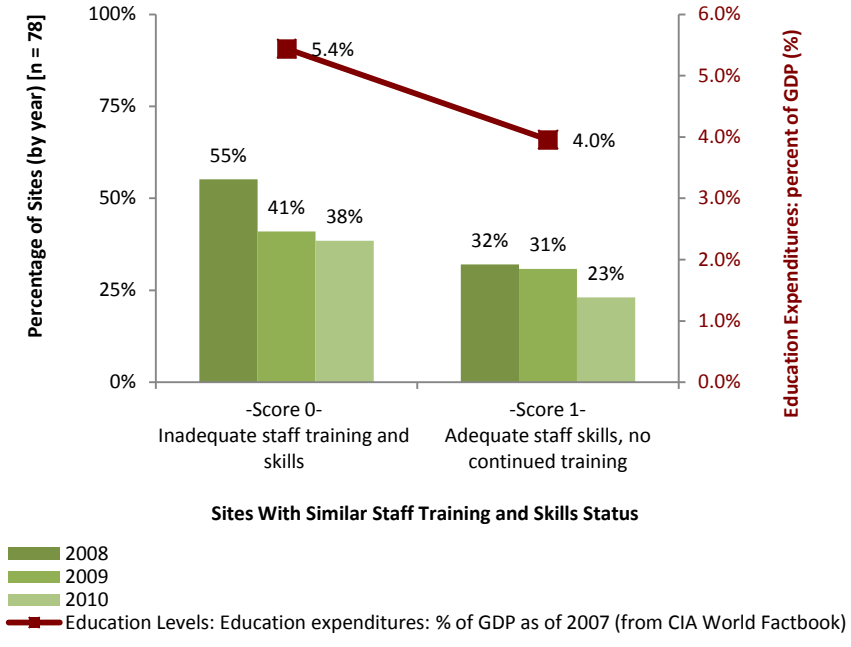


Figure 17.8 Adequate Staff Training and Skills and Education Expenditures: Country Comparison to the World (Out of 186)

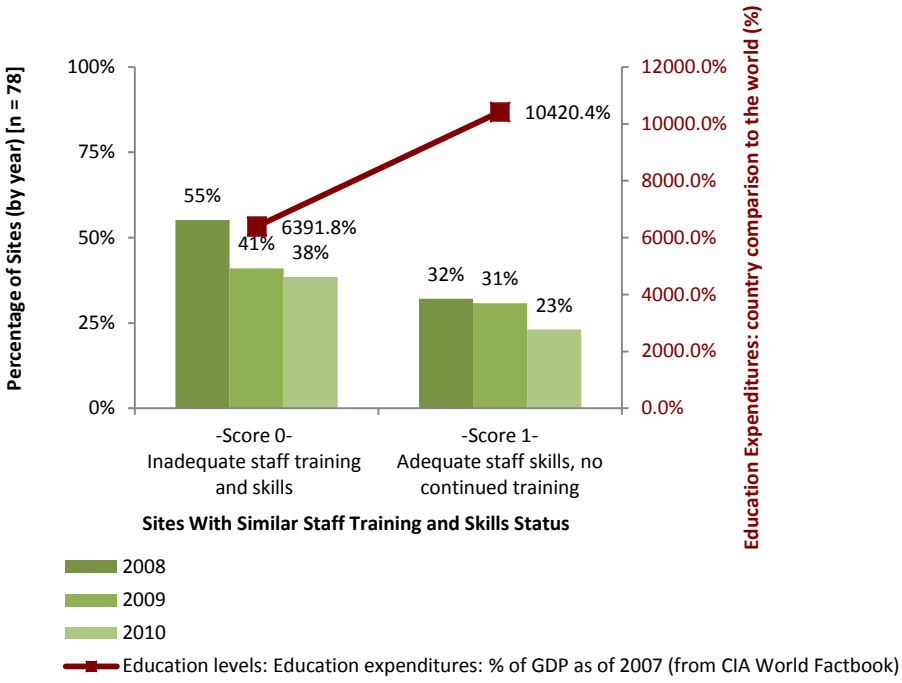


Figure 17.9 Adequate Staff Training and Skills and Number of Endemic Species

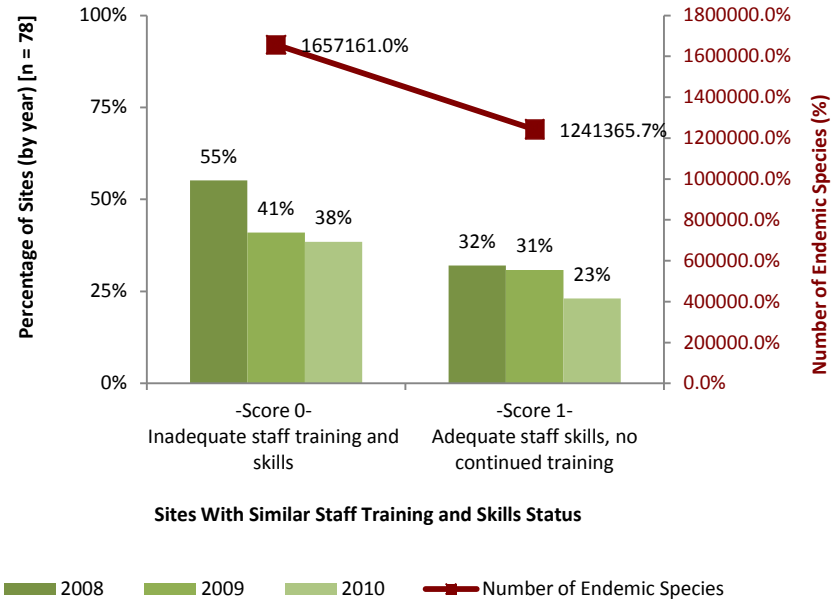


Figure 18.1 Appropriate Budget for Identified Management Costs

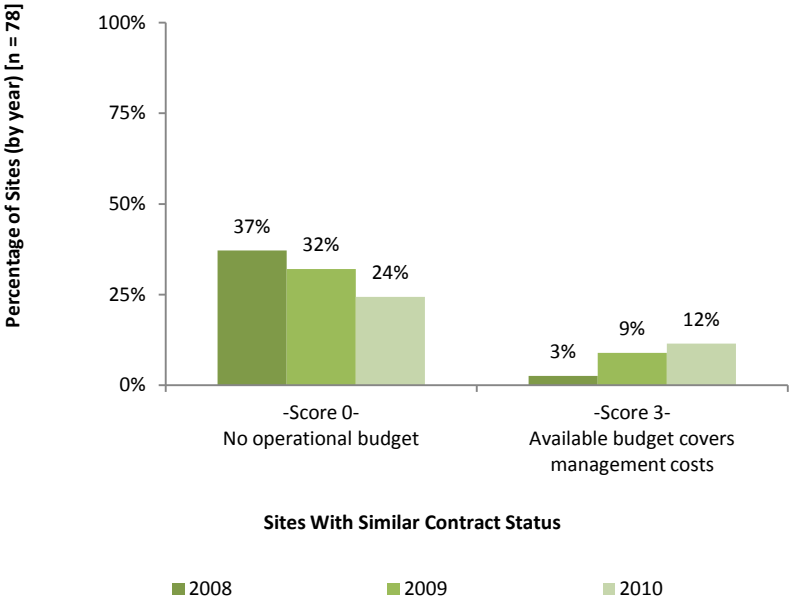


Figure 18.2 Appropriate Budget for Identified Management Costs and Population Density

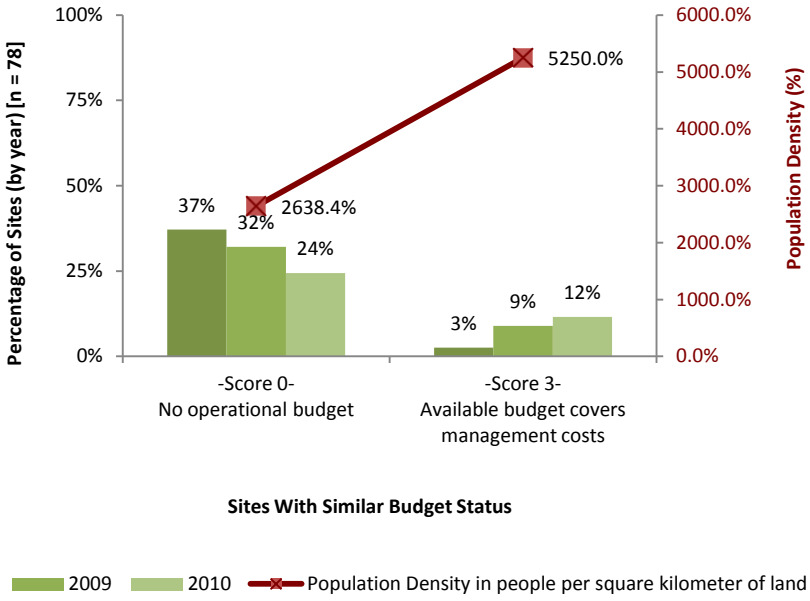


Figure 18.3 Appropriate Budget for Identified Management Costs and % of Population Urbanized

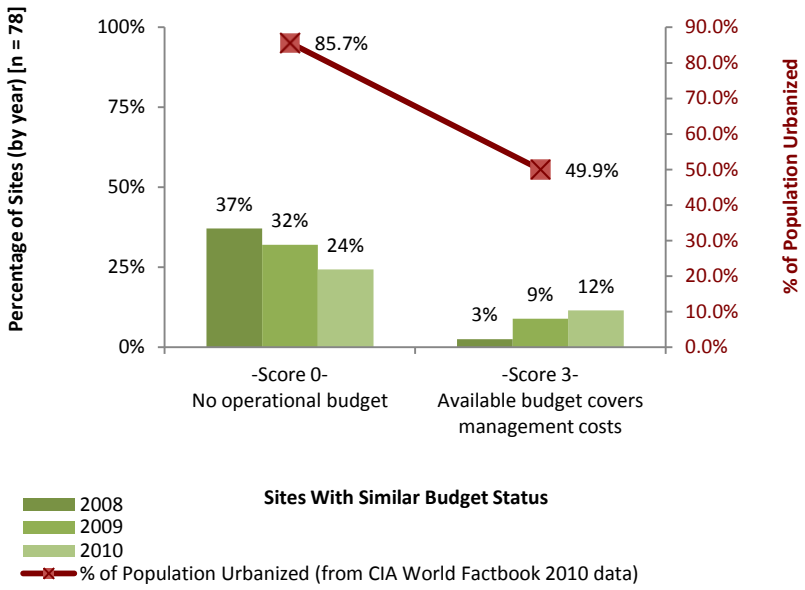


Figure 18.4 Appropriate Budget for Identified Management Costs and Urbanization Rate

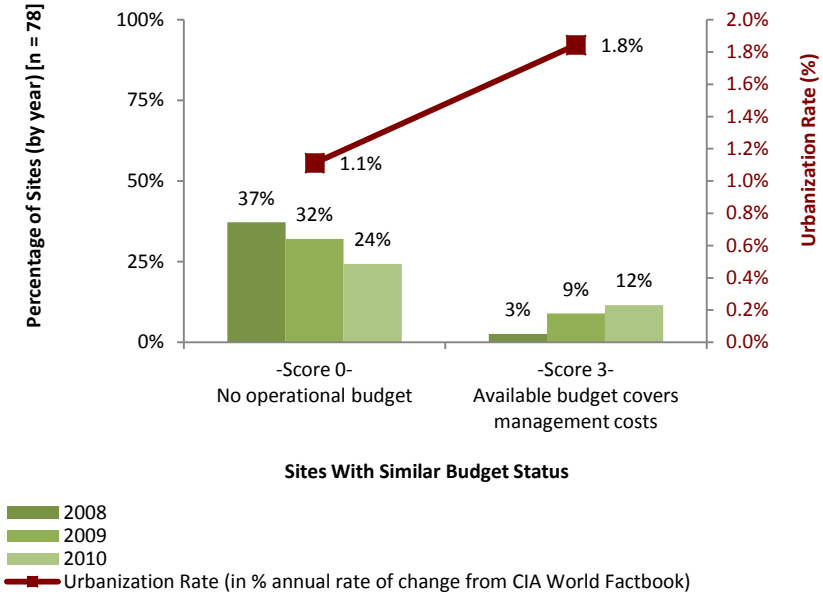


Figure 18.5 Appropriate Budget for Identified Management Costs and HDI Scores

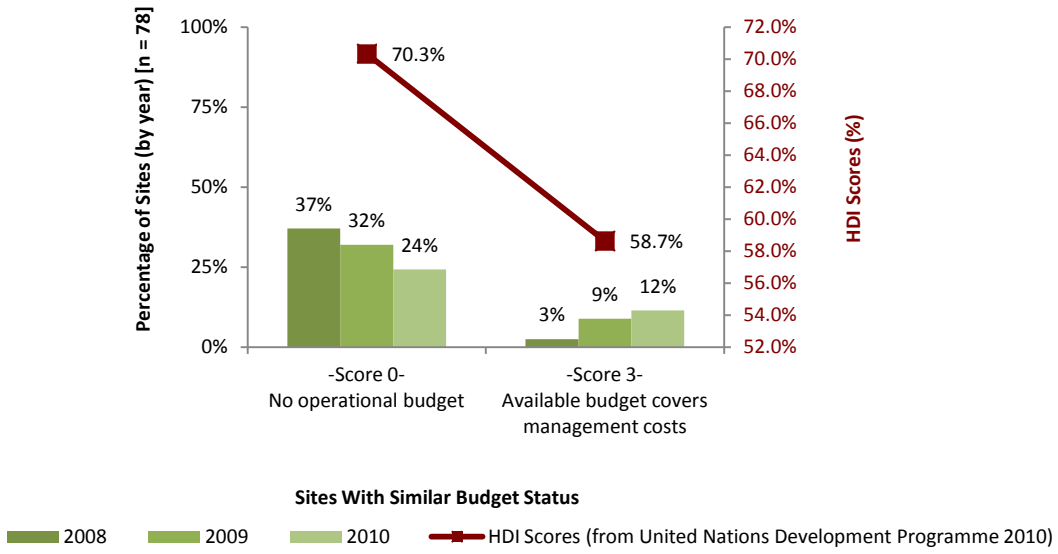


Figure 18.6 Appropriate Budget for Identified Management Costs and GNI per Capita

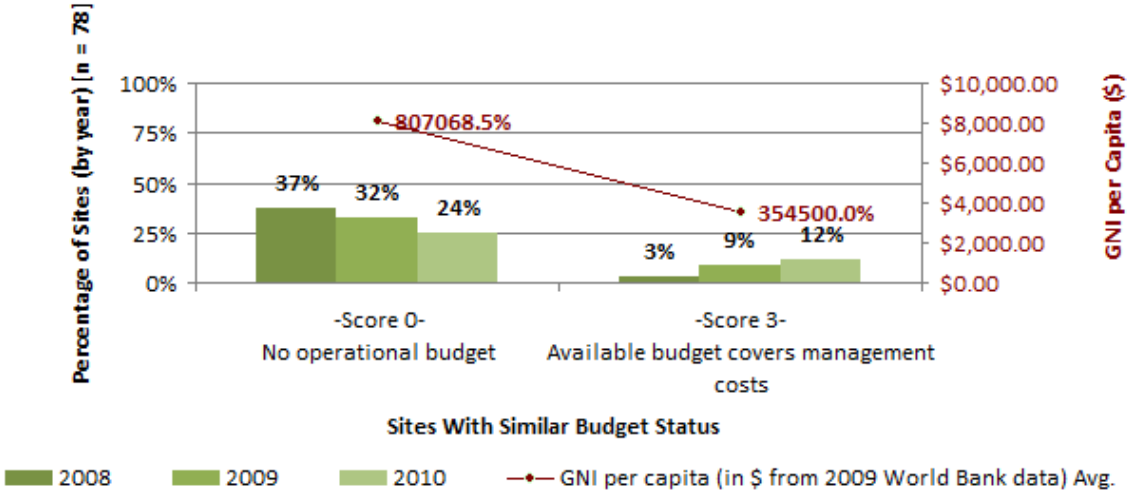


Figure 18.7 Appropriate Budget for Identified Management Costs and Education Levels: Literacy rate (%)

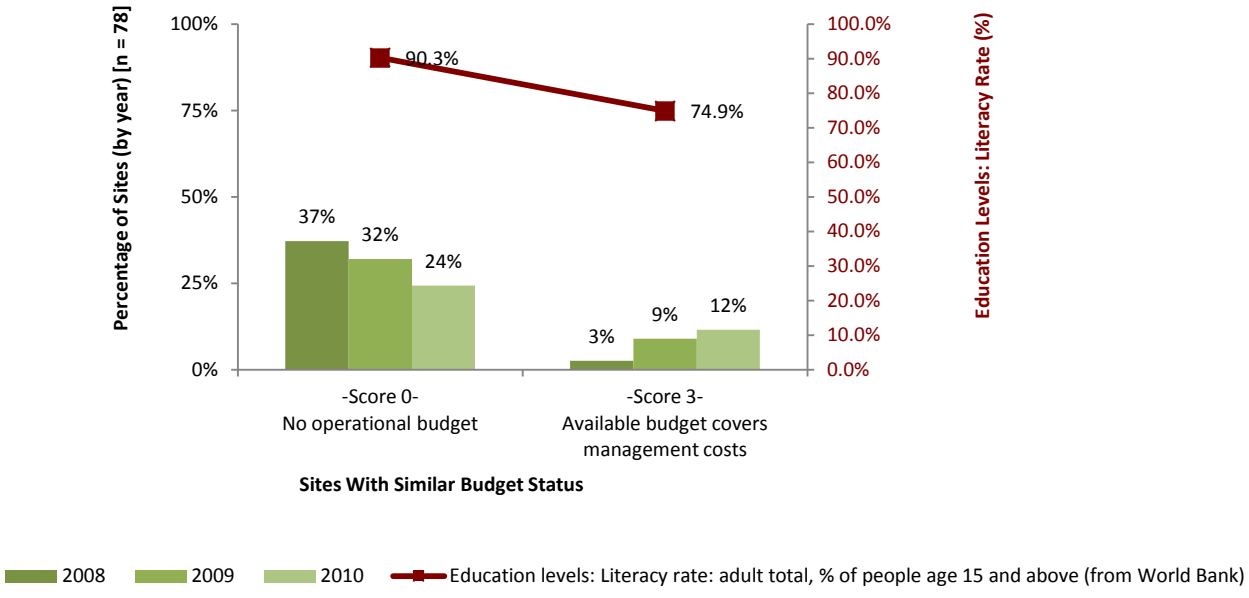


Figure 18.8 Appropriate Budget for Identified Management Costs and Education Expenditures: Percentage of GDP as of 2007

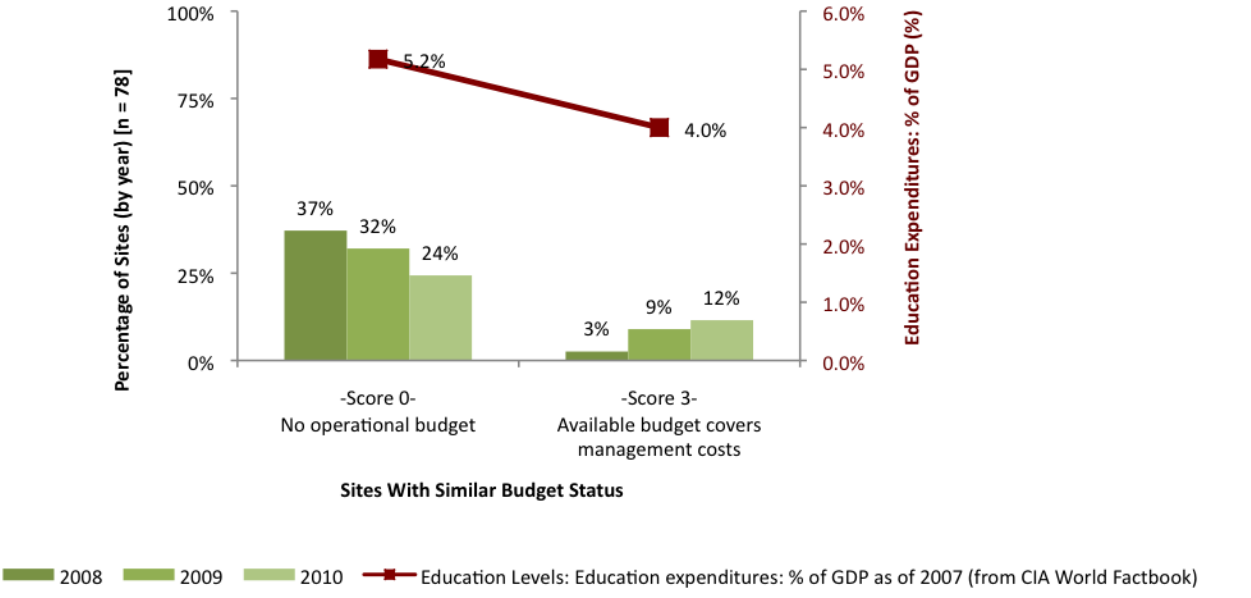


Figure 18.9 Appropriate Budget for Identified Management Costs and Education Expenditures: Country Comparison to the World

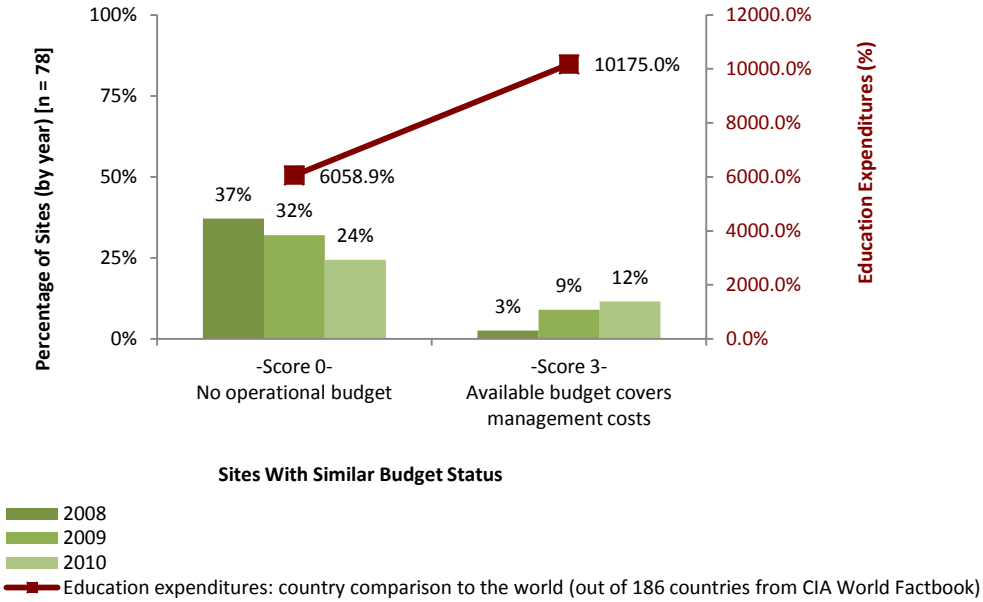
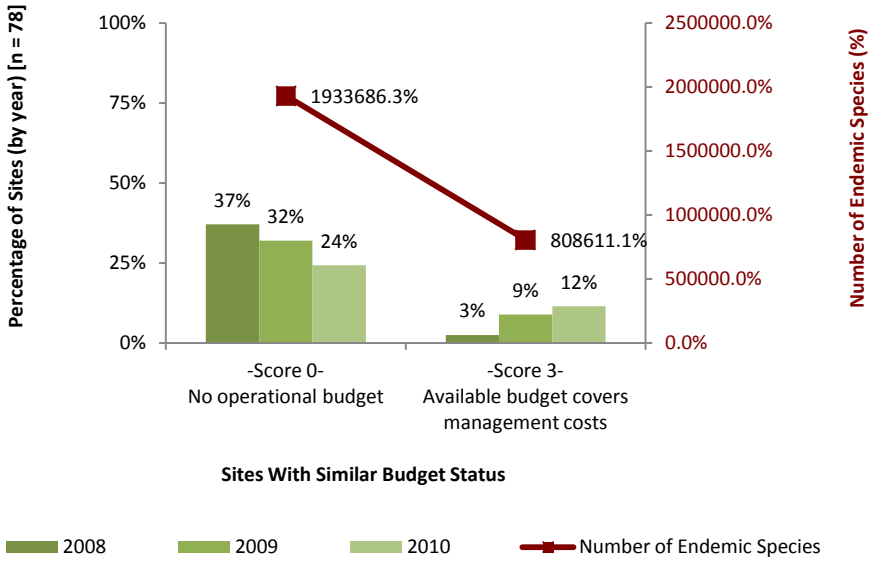


Figure 18.10 Appropriate Budget for Identified Management Costs and Number of Endemic Species



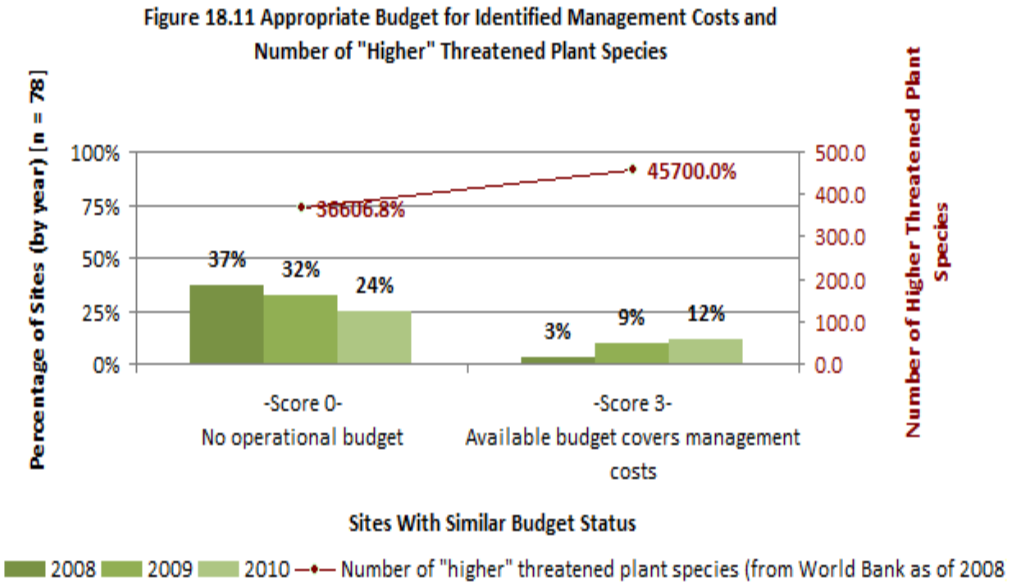


Figure 18.12 Appropriate Budget for Identified Management Costs and Percent Employment in Agriculture

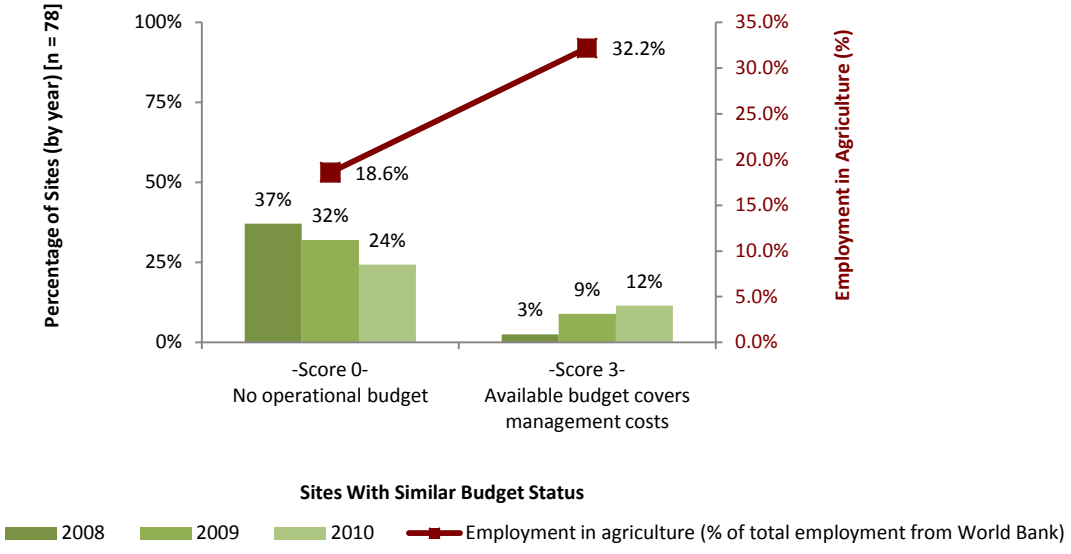


Figure 19.1 Boundary Demarcation

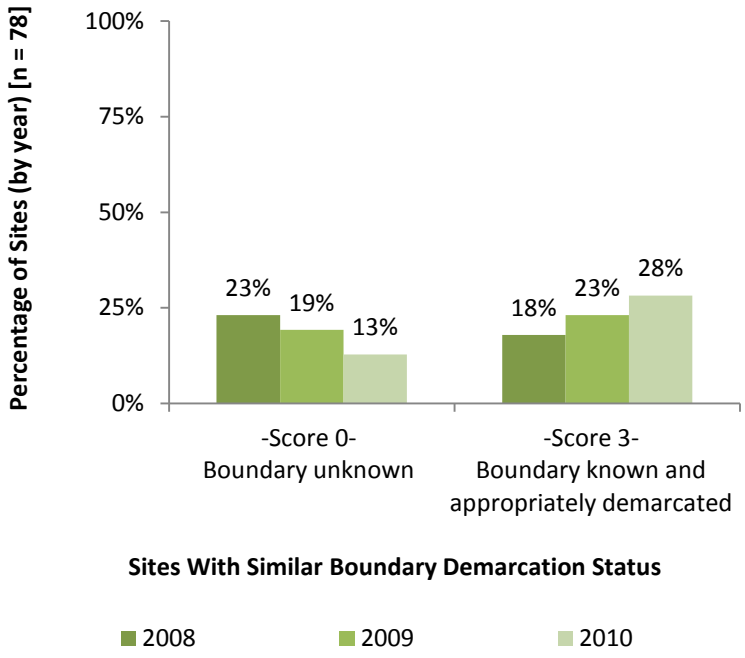


Figure 19.2 Boundary Demarcation and Population Density

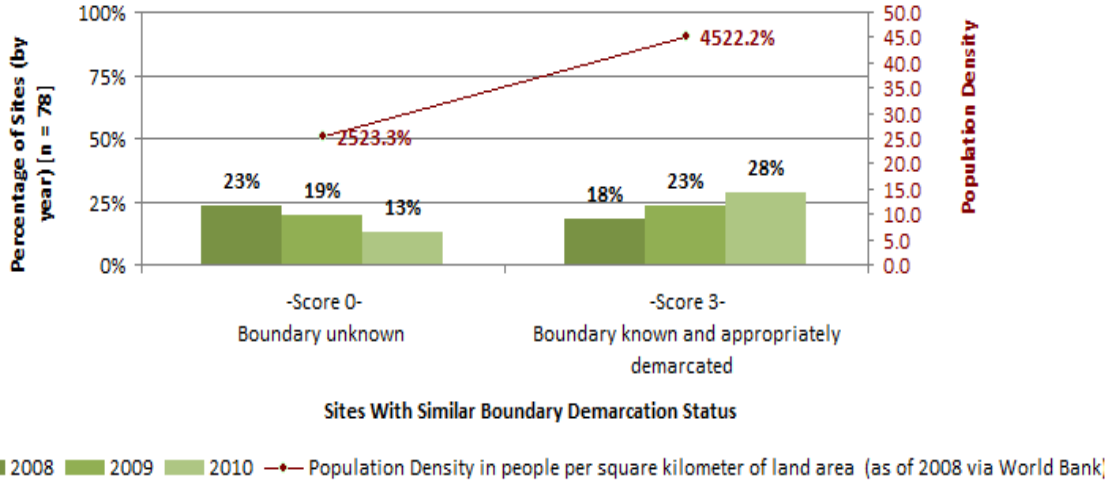


Figure 19.3 Boundary Demarcation and Percentage of Population Urbanized

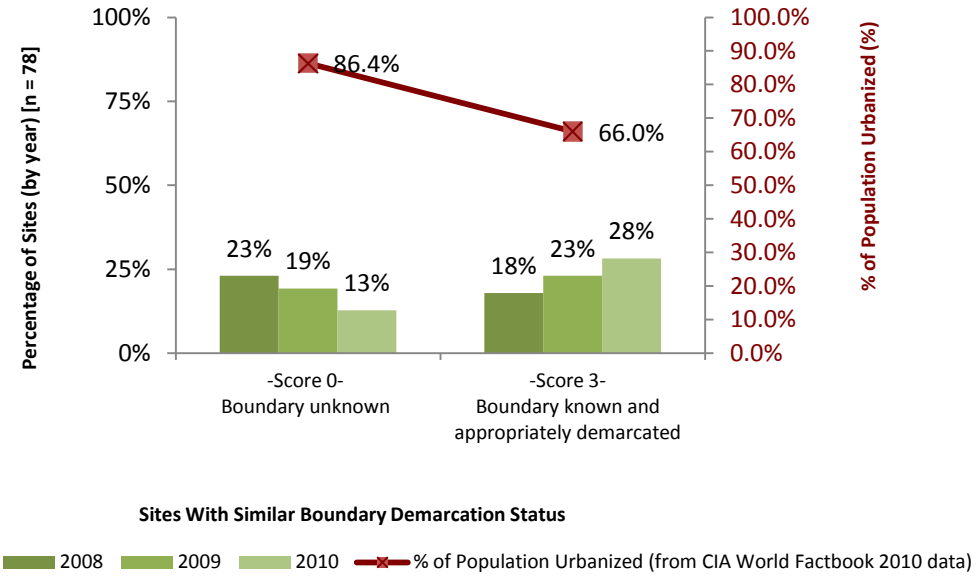


Figure 19.4 Boundary Demarcation and Urbanization Rate

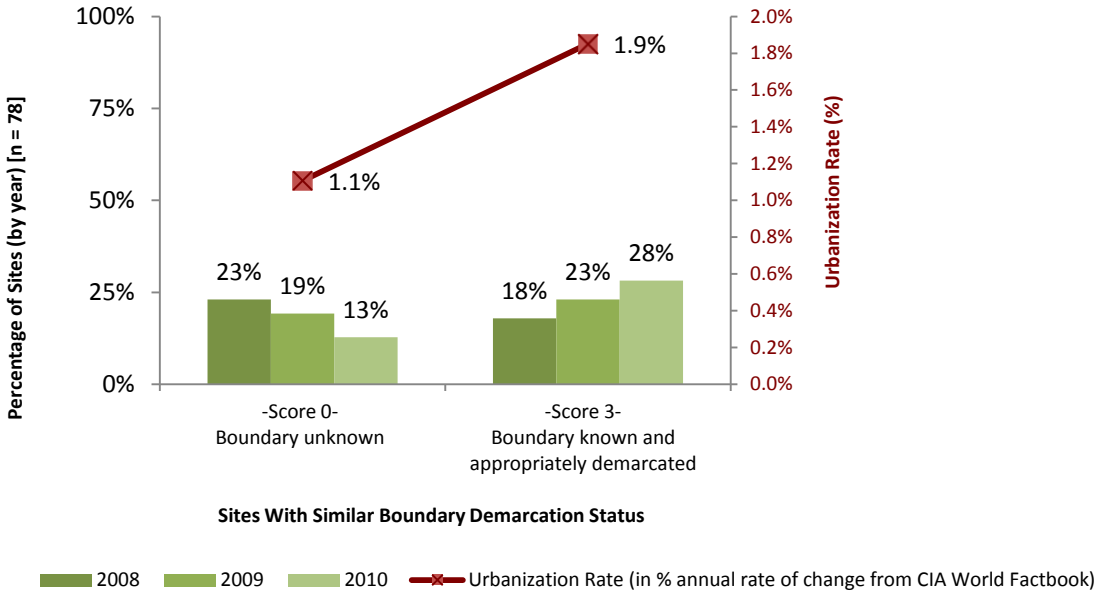


Figure 19.5 Boundary Demarcation and Population Growth Rates

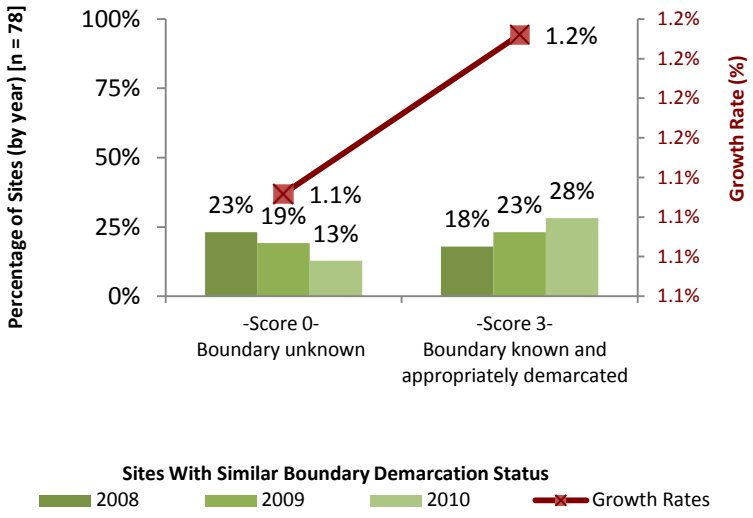


Figure 19.6 Boundary Demarcation and HDI scores

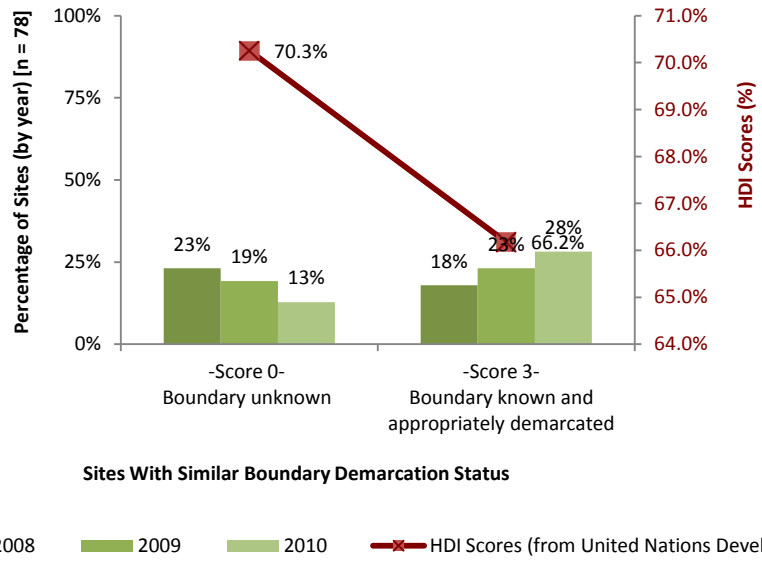


Figure 19.7 Boundary Demarcation and GNI per Capita

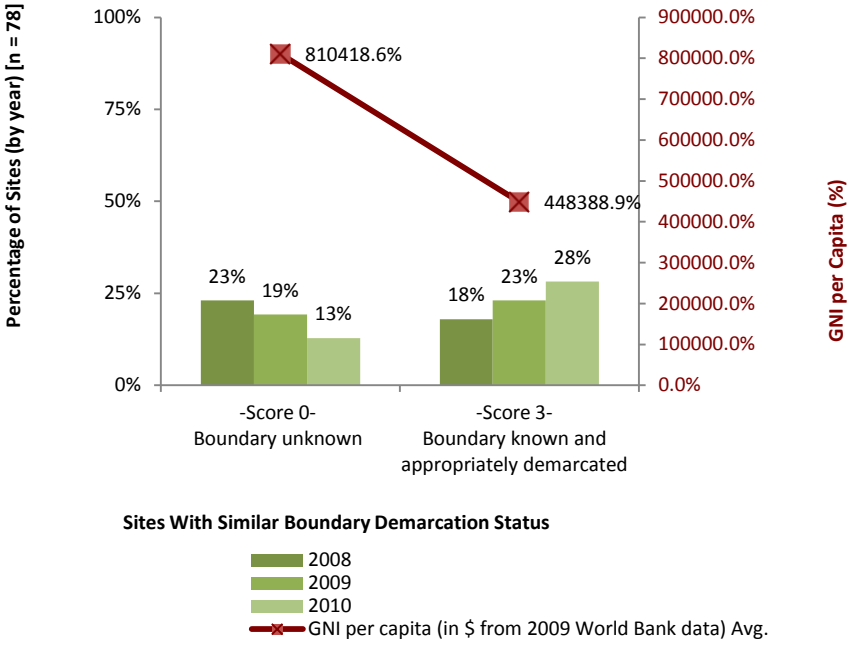


Figure 19.8 Boundary Demarcation and Education Expenditures: Percentage of GDP (2007)

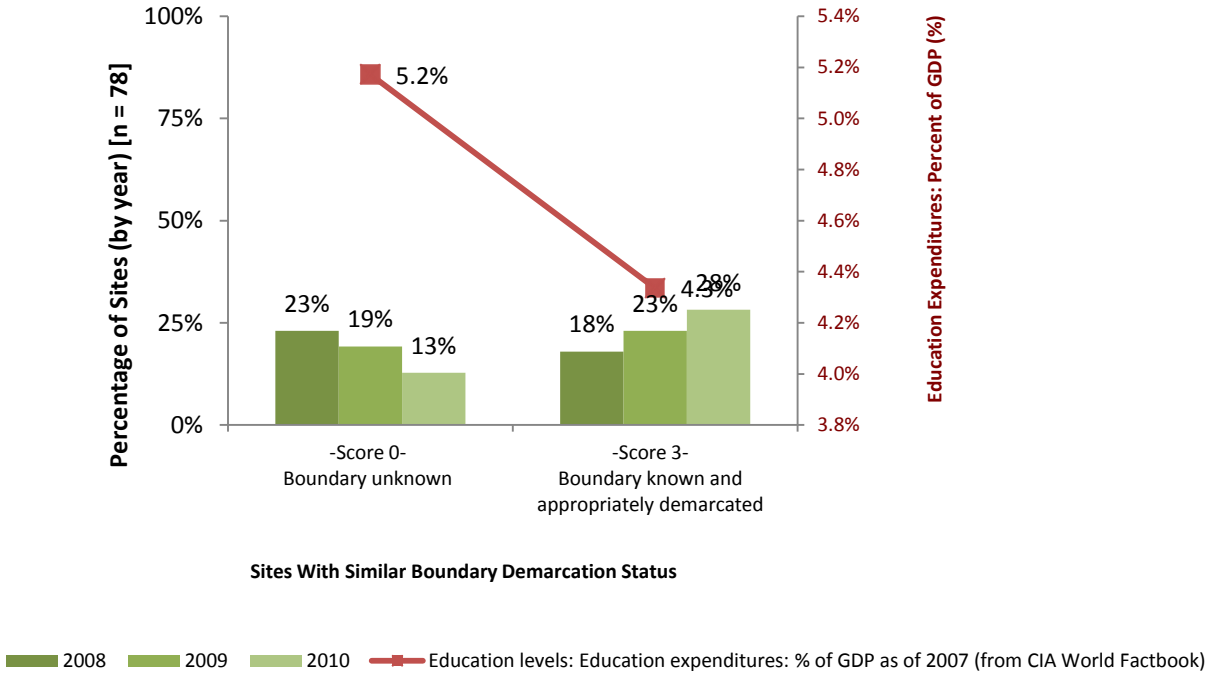


Figure 19.9 Boundary Demarcation and
Education Expenditures: Country Comparison to the World

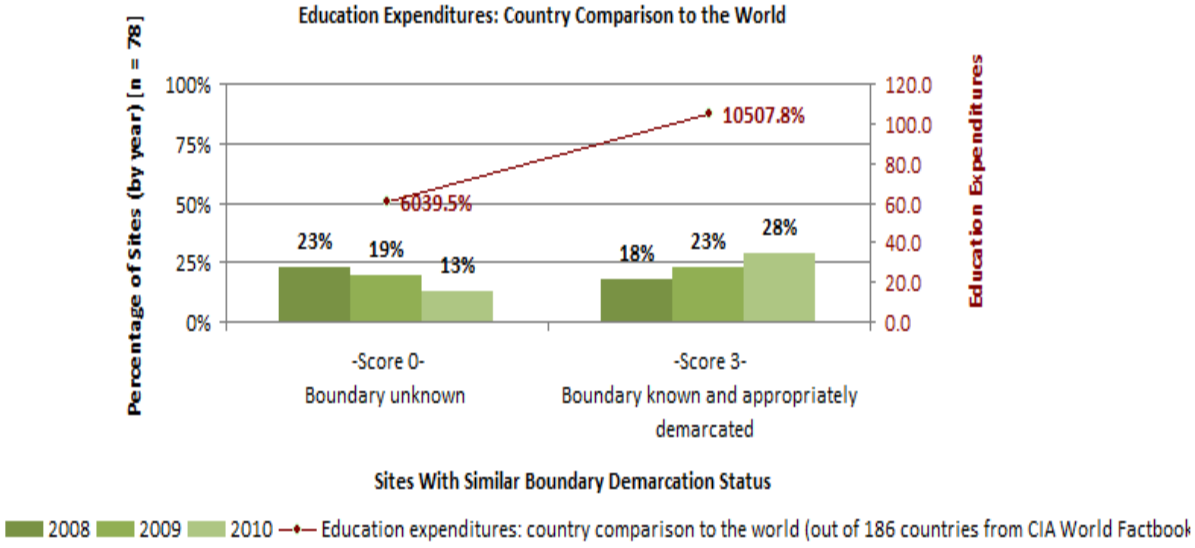
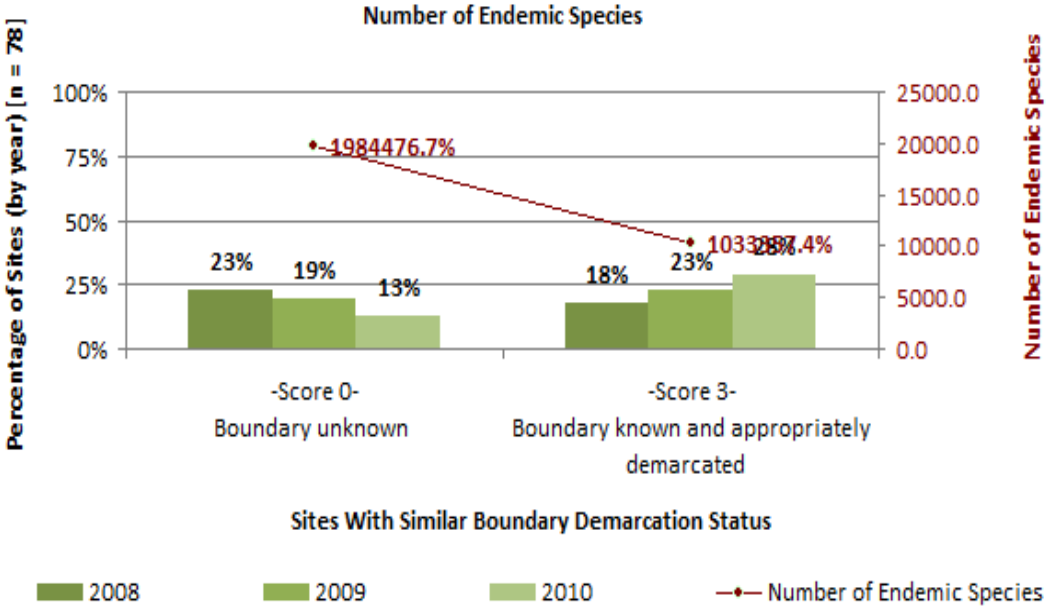


Figure 19.10 Boundary Demarcation and
Number of Endemic Species



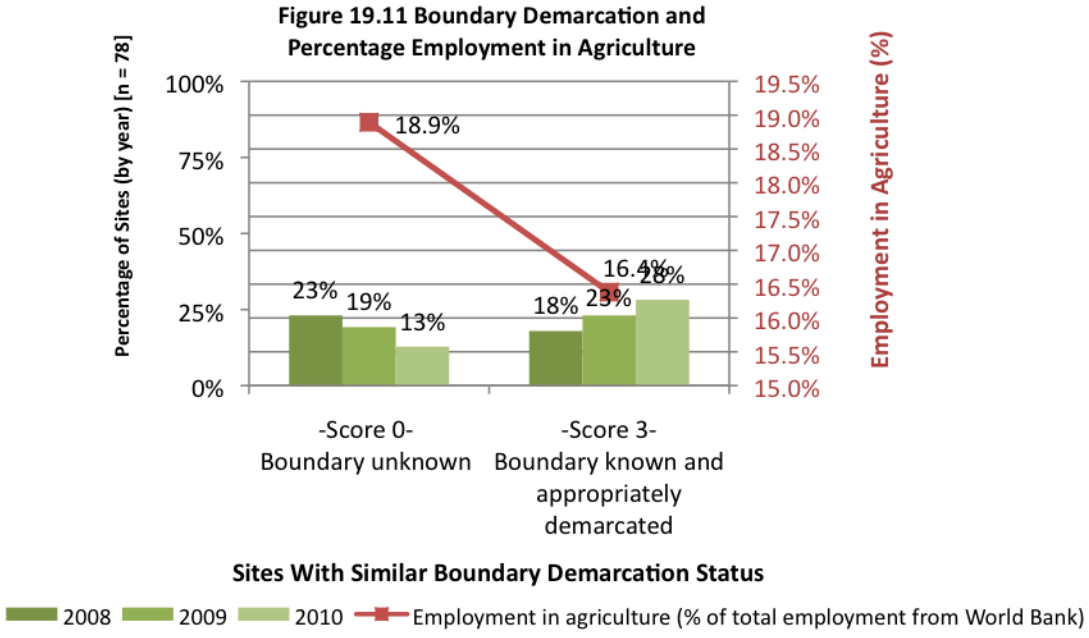


Figure 19.11 Boundary Demarcation and Percentage Employment in Agriculture
Percentage of Sites (by year) [n = 78]
100%
75%
50%
25%
0%
19.5%
19.0%
18.5%
18.0%
17.5%
17.0%
16.5%
16.0%
15.5%
15.0%
Employment in Agriculture (%)
18.9%
23%
19%
13%
18%
23%
28%
-Score 0- Boundary unknown
-Score 3- Boundary known and appropriately demarcated
Sites With Similar Boundary Demarcation Status
2008
2009
2010
Employment in agriculture (% of total employment from World Bank)