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Bhattacharya, Tania Ray and Managi, Shunsuke

Yokohama National University, Tohoku University

7 June 2012

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Tania Ray Bhattacharya [1] and Shunsuke Managi [2, 3]

1: Faculty of Business Administration, Yokohama National University, 79-4, Tokiwadai, Hodogaya-ku, Yokohama 240-0067, Japan.
2: Associate Professor, Graduate School of Environmental Studies, Tohoku University, 6-6-20 Aramaki-Aza Aoba, Aoba-Ku, Sendai 980-8579, Japan. Tel：022-795-3216, Fax: 022-795-4309; E-mail: managi@mail.kankyo.tohoku.ac.jp
3: Graduate School of Public Policy, University of Tokyo, Japan

Abstract

This paper assesses the current activities of U.S. Fortune 500 companies with respect to global biodiversity protection and the goals of the Convention of Biological Diversity (CBD). Data and information collected from five hundred companies within eight major industrial sectors was further categorized at the company level to assess each company's involvement in global biodiversity protection. Our findings show that although companies' business profiles highly influence their decision-making process regarding the adoption of biodiversity protection policies and measures, their revenue profiles are less influential. We show that despite generating low revenues, companies in the utility sector are more active in the adoption of biodiversity protection policy than are those in the financial sector, which generates high revenues. This study also demonstrates that companies must be convinced of the major effects of biodiversity loss on their bottom lines to be motivated to protect biological diversity. Companies' business and business related risk profiles can also influence the adoption of biodiversity protection policies within the company. The study further demonstrates that a measurable biodiversity impact indicator is necessary for the companies to get seriously involved in the mitigation action. Finally this study proposes a three step biodiversity loss mitigation action framework which is drawn upon the assessment of the 500 companies which can contribute to develop an elaborative framework of business sector specific mitigation plan.

Key Words: Biodiversity, business sector, Fortune 500 companies, business risk, revenue

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[2] Corresponding Author: Shunsuke Managi, Tel：022-795-3216, Fax: 022-795-4309; E-mail: managi@mail.kankyo.tohoku.ac.jp

1. Introduction

Since the inception of the UN Convention on Biological Diversity (CBD) in 1993, little progress has been achieved in terms of involving the business community in protecting the biological diversity worldwide. According to the CBD, biodiversity refers to "the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems" (Article 2, Convention On Biological Diversity). Even for guiding investment, the biodiversity convention is perhaps the least specifically prescriptive global environmental convention (Moran et al.1996). A wide gap still exists between the actions inducing climate change and the conservation of ecosystem and biological diversity (Heller and Zavaleta 2008). Thus far, efforts have been made mainly by the non-commercial sector including non-governmental organizations (NGOs). Most international funding for biodiversity conservation is received from high-income countries' Overseas Development Assistance (ODA). All market-based mechanisms, including ecotourism, environmentally friendly products marketing, and payments for ecosystem services (PES), provide approximately 1 to 2 billion USD per annum (Gutman and Davidson 2007), which is profoundly insufficient to meet the current need . Most funds are used for biodiversity and ecosystem service-related academic work and for a few demonstration projects that have limited impact on the ground (Gutman and Davidson 2007).

It has been estimated that the global biodiversity resource has been declining continuously over the last several decades mainly due to increasing anthropogenic interferences (FAO 2010)[3]. The CBD targets for 2010 are yet to be achieved fully in any aspect, including policy intervention, international finance, technology transfer, and patent issues (Butchart et al. 2010). In the recent statement of the Executive Secretary of the CBD in the Rio+20 summit (June 2012), it is clearly mentioned that CBD is so far failed in all its given assignments. In the process of investigating the reasons of such failure it is also identified that lack of mainstreaming of ecosystem and biodiversity in the economic planning and economic sector is one of the major reasons (CBD 2012). As a matter of fact, business sector has a major role to play in terms of mainstreaming ecology and biodiversity conservation not only to have a sustainable business but also to mitigate the impacts of loss of biodiversity caused by the economic and business activities across the world. In the 2010 Report for Business in The Economics of Ecosystems and Biodiversity (TEEB 2010), which

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[3] Food and Agriculture Organization (FAO) reported that since 1900 more than 75% of the total global plant genetic diversity has been lost. (The Second Report on THE STATE OF THE WORLD's PLANT GENETIC RESOURCES FOR FOOD AND AGRICULTURE 2010).

is so far one of the most comprehensive reports on the general issues of business and biodiversity linkage, it was repeatedly emphasized the importance of business sectors' involved in the whole process of conservation and protection of ecology, biodiversity and environment. Business sector with its financial and technological resources can indeed play a key role in the whole process. Conversely, in many cases, businesses are also responsible for the loss of biodiversity. For example, most multinational companies now operate their manufacturing units outside of their countries of origin to enjoy multiple benefits, such as low production costs, less stringent laws and regulations (including environmental laws) and relatively easier utilization of natural resources, all of which can accelerate the local biological diversity loss (Mahidhar et al. 2009). Compared with climate change issues, biodiversity has generated low levels of international response (Heller and Zavaleta 2008).

Biodiversity being a public good, who's open and free use by one person doesn't bar others to use it free at the same time, it's true value is thus not realized by the market. As a result the economy is unable to quantify the cost of externalities of biodiversity loss (Metcalfe et al. 2010). Sustained investment in global biodiversity monitoring and the development of measurable indicators are essential to track and improve the effectiveness of biodiversity protection initiatives (Walpole et al. 2009). The public and private sectors are equally important in this process to achieve the target.. A growing number of evidence indicates that private-sector companies engaged in the mitigation of biodiversity loss are now reporting corresponding positive commercial and reputational impacts on their business activities (Metcalfe et al. 2010). If the policies such as labeling for environmental friendly goods are produced in a less costly operational method and sold well in the market, this will provides opportunity for win-win situation. In one hand there is growing number of scientific evidences of rapid loss biodiversity which predicts severe impacts on the sustainable development and on the other hand there is lack of mitigation tools which can halt the loss of biodiversity. Though there is no single silver bullet for this solution, but multi facet actions are required which includes mainstreaming of ecosystem and biodiversity conservation in the economic and business planning and activities.

Since biodiversity and ecosystems act as business inputs, the negative impact that they suffer eventually poses risks to companies. For water-intensive business processes such as agro-business, power generation and pulp and paper processing, negative impacts on water availability and water quality might create severe business risks in terms of raw material supply constraints, higher procurement costs and quality of production. Similarly, for companies that are heavily dependent on land resources, biodiversity loss in land and soil may result in additional business risks resulting from yield reduction, soil contamination,

pesticide overflows and other related consequences[4]. Biodiversity loss or degradation can affect not only business outputs but also company reputation and goodwill due to a degraded local environment and adverse health impact on the local communities

Understanding the importance of biodiversity and ecosystems in the context of sustainable business and development, growing number of literatures are now getting published in this area. Majority of the current literatures discuss the relationships between biodiversity and business in terms of the corporate social responsibilities (CSRs) of the private sector to protect biological diversity (TEEB for Business 2010). Rondinelli and Berry (2000) conducted a content analysis of the environmental performance reports of 38 companies; their findings showed that multinational companies (MNCs) of different sizes and from different industries are adopting similar types of sustainable development programs (including biodiversity protection) because proactive environmental management provides immediate and direct business benefits, i.e., lower costs, fewer risks and liabilities, and more efficient operations. However, they concluded that externally oriented programs such as corporate citizenship activities reflect a small portion of the environmental management activities and frequently do not provide the most potential for achieving sustainable development. The review of multinational companies' environmental performance reports indicates that regardless of the type of green activities, most of the companies operate proactively when they see business benefits derived from a responsible environmental image (Rondinelli and Berry 2000). Dyke et al. (2005) argued that publicity for environmental action is an important issue for the timber industry. Most of this publicity issues are related to the corporate forest management.but forestry certification, wildlife management and land exchanges were also ranked as popular topics.

The TEEB Report for Business (2010) also argued that business sector gets motivated to invest more in the protection of biodiversity and ecosystems provided they observe that the serious damage to the ecosystem caused by the business activities can jeopardize company's reputation or can disrupt supply chain of raw materials or the protection activities can bring good payback in the near future.

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[4] Previous studies identified the potential burdens and stressors to water and land created by the different sectors in various stages of their life cycles (Asian Development Bank1997) Businesses create emissions during various stages of their life cycle that potentially impact the biodiversity. However, to prepare the life cycle analysis of these industries, more significant efforts could be made to apply sustainability accounting using fieldwork and case-oriented research methods (Lamberton 2005).

Vickerman (1999) further argued that private players must have an important role in the protection of biological diversity. In this context, the importance of public-private partnerships in addition to individual company efforts was emphasized. Private lands must be included in biodiversity protection strategies to bring more ownership to the entire process than there would be with the public land. Therefore, incentive schemes like stewardship incentive program and tax incentives could be used to entice individuals to work to conserve biodiversity. The Millennium Ecosystem Assessment (MEA) presents a concrete account of biodiversity loss and ecosystem degradation (MEA 2005). The TEEB (2010) also analyzed business leaders' growing concerns about the risk of biodiversity loss and the requirements for preserving ecological limits.

Martens et al. (2003) identified declining biodiversity to be not only an environmental problem but also a socio-economic problem. Hence, the preservation of biodiversity requires that industries and consumers' production patterns change. The TEEB for Business (Chapter 2, 2010) discussed the interconnections between business and biodiversity that are highly influenced by consumer preferences. A recent survey of over 13,000 individuals further supports that idea. Eighty-two percent of Latin American consumers were more concerned, followed by 56% in Asia, 49% in the United States and 48% in Europe. The demand for products that are ecologically certified by the Forest Stewardship Council (FSC) and the Marine Stewardship Council (MSC), as well as the demand for Rainforest-Alliance-certified coffee, supports these findings. For branded fast-moving consumer goods, eco-labeling is moving from niche to mainstream markets. Examples include Domtar (FSC-certified product), Mars (Rainforest alliance cocoa), Cadbury (Fair-trade cocoa), and Unilever (Rainforest Alliance PG Tips). Wal-Mart now scores its suppliers based on their concern for the protection of biodiversity and natural resources and uses eco-labels for all of its brands. Cosmetics companies such as Natura and L'Oreal have adopted the sustainable use of biodiversity as the main driver of innovation and aim to use plant-based ingredients in the manufacturing of their products. Essentially, the TEEB for Business (Chapter 2, 2010) showed the general impact and dependence on biodiversity and ecosystem services across several business sectors.

Doremus (2003) suggested a policy portfolio approach to protecting biodiversity on private lands. In the United States, more than 90% of the listed endangered and threatened species maintain their habitat on private lands, and approximately two-thirds of these species depend on these lands for the majority of their habitat (U.S. General Accounting Office 1995; Groves et al. 2000). However, biodiversity protection for privately owned lands has always been problematic. No particular policy measure is perfect; rather, a broad

spectrum of conservation options is more likely to be effective, and the optimal portfolio of policies may combine state and private actions.

The participation of private actors is only possible under specific conditions. According to Olson's theory (Olson 1965), rational self-interested individuals will not act in the interest of the group because individual costs exceed individual benefits. Without selective incentives to motivate participation, collective action is unlikely, even by large groups of people with common interests. Because biodiversity protection may not provide an immediate economic gain, an external regulatory force is necessary (e.g., a civil society such as Global Action Network) to solve the collective action problem. Thus, civil society's role in conservation and biodiversity policies is important (Glasbergen 2010). A range of public policy measures like green development finance (GDF) and payment for ecosystem services (PES) can increase the scale of biodiversity and ecosystem conservation services to generate more business opportunities.. Such measures can be defined as a voluntary transaction where a well-defined ecosystem service or a land use policy is likely to be secured while the service is purchased by at least one buyer from at least one provider (Wunder 2005), access and benefit sharing, tax incentives and performance standards among other benefits. (TEEB for Business chapter 5, 2010). Generally, neither the government nor the private sector includes the protection of biodiversity and ecosystem services in its financial accounting and reporting. The World Business Council for Sustainable Development (WBCSD) is currently working on this limitation.

The discussion above is based on the existing literatures and provides important information on the private sectors' role and potential importance in terms of conserving biodiversity and ecosystems on the earth. It is also discussed about the importance of private sectors' role in terms of financial support which is the key for the success of this conservation activities This is an important issue because biodiversity protection requires significant financial support that is contingent on active private sector participation. Although the existing literatures focus on the private sector's concern for biodiversity protection and make policy recommendations for the same, but there is a gap of business sectoral analysis in the context of biodiversity and ecosystem conservation, . It is so far understood that the business and biodiversity has a causal relationship but its functioning and complicacy is yet to be revealed. This study attempts to bridge the gap between the general understanding of the relationship of business and biodiversity and the business sector specific relationship which are assumed to be different for every sector. Within this context, this paper first assesses the involvement of Fortune 500 companies' in biodiversity protection with respect to the clarity of their policies regarding biodiversity and their contributions towards achieving the targets set by CBD. Section 2 discusses existing works on business and biodiversity that

distinguish this study. Section 3 explains the data and methodological issues. Section 4 presents this study's findings and Section 5 analyzes related policy issues where we show how several policy recommendations regarding biodiversity protection may be incorporated effectively in long-term business strategies.

We believe that this study will benefit policy makers and the private sector. Although the private sector is increasingly funding a number of ecosystem services, particularly carbon sequestration, little is known about the potential willingness of this sector to fund other ecosystem services, such as biodiversity conservation (Waage et al. 2007). Our research aims to address this knowledge gap. By indicating the leading Fortune 500 companies' concerns about the protection of biodiversity and ecosystem services, this study can help policymakers and the private sector with their future environmental protection activities.

2. Data and Methodology

This study primarily collected data and information on companies' biodiversity policies from the major 500 U.S. companies mentioned under the Year 2007 Forbes Fortune 500 list (CNN 2007). Selection of companies is done following the Fortune 500 list published by the Fortune Magazine. All 500 companies are selected for this study at the first stage. Then classification has been done based on their respective business categories.. We thoroughly analyzed the contents of these companies' CSR report, sustainability report, and/or the annual reports (depending on the availability from each company's website) to determine whether the companies have specific biodiversity policies.

2.1 Data structure and definitions

In this study, whether or not a firm has a specific biodiversity policy depends on the clarity of biodiversity protection reporting in the CSR report, sustainability report and annual report. Firms that lack such specific reporting but still conduct several similar activities funded by NGOs/NPOs are not considered to have specific biodiversity policies. Many companies with specific policies related to various ecosystem services such as water resource protection but without a description of specific biodiversity policies also were not considered to have specific biodiversity policies.

During the first step of the assessment, we analyze the top 500 companies listed in the April 30th, 2007 issue of *Fortune* magazine published online by CNN, which is a Time

Warner Company (web source: http://money.cnn.com/magazines/fortune/).[5] We analyze the various biodiversity protection initiatives reported in the publications of these companies, including annual reports, corporate social responsibility reports, environmental assessment reports and environmental impact assessment reports; our main purpose is to identify the companies' ongoing and overall activities related to biodiversity. Finally, in our analysis, whether a company has its specific biodiversity policy based on its direct reporting on biodiversity protection and related activities under any of its action plan and no indirect action has been considered. For example, several companies have specific policies related to various ecosystem services such as water resource protection; when a company issues no work or policies on issues directly related to biodiversity, we do not consider this company to have a biodiversity policy. To avoid double counting and overlapping with other policies, we consider only the directly mentioned policies.

The top 500 companies are selected based on their annual revenue generation (in dollars) in the 2007 fiscal year. First, we obtain all 500 companies' biodiversity-related policy actions on a binary response (i.e., "yes"/"no") basis. This initial screening reveals two sets of companies: those with and those without biodiversity-related policies. Next, we categorize all companies into 74 sectors consistent with the *Fortune* magazine classification (see Annex-I for the detailed sector list). Finally, for each sector, we calculate the percentage of companies with direct biodiversity policies. This percentage indicates how many companies of a particular sector are concerned with biodiversity issues. We call this a measure of a company's biodiversity policy responsiveness. Sectors are ranked from 1 to 74 based on these percentage figures and on the annual revenue generation of the companies provided by the Fortune 500 list.

2.2 Classification of the companies The Fortune 500 is a list compiled by Fortune magazine raking the top 500 public corporations of the US as measured by their gross revenue adjusted to their excise duty payment. Based on North American Industry Classification System (NAICS) Fortune 500 list inherently became categorized like manufacturing, utilities, finance and banking, retail etc. It has been estimated that manufacturing, finance, retail and utilities are put together comprising around 70% of the total 500 companies in the list. Further World Economic Forum, for the convenience of analysis of the business sector and their impact on environment, categorized the remaining 30% of the companies with four additional categories like consumer goods, consumer

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[5] The revenue ranking is based on 2007 because only figures for that year were available online (accessed October 2010) during the course of this research. However, these rankings have not changed much between 2007 and 2010 (the ranking correlation for the two years is 0.987), so our data are sufficiently up to date. The company websites were accessed in October 2010.

services, healthcare and technology & business services. Therefore, in total Fortune 500 companies got 8 major categories. However, in this study, we further created sub categories of the 500 businesses following a combined sector definitions of NAICS and WEF for the purpose of detailed assessment. We therefore, created 74 sub categories of companies spread over 8 major sectors. Each sub category is thus unique in business nature and mutually exclusive to each other. Such exclusivity was necessary to provide independence to the result obtained in the process of our analysis.

3. Results

In this section we have first described the classification of the 500 odd companies under the broad categories of business activities along with their corresponding activities related to the biodiversity and ecosystem conservation and protection and certain important percentage indicators. Second, we discussed about the relationship between various indicators of biodiversity policy adoption and finally we discussed about the causal relationship between business risks, business revenue and biodiversity policy adoption under different business categories among the Fortune 500 companies.

3.1 Sectoral classification and characteristics of the Fortune 500 companies in terms of biodiversity policies

We aggregated the 74 sectors into 8 major sectoral business categories based on the World Economic Forum report on business and biodiversity. Table 1 shows the behavior of the primary and utility sectors in terms of percentage of companies report their biodiversity policies under each sector category and percentage among the total 500 companies. The last column describes the reasons of adoption and / no-adoption of biodiversity protection policy. Table 1 further demonstrates that almost all the companies under the the primary and utility sectors have certain biodiversity policy in place.

[Table 1]

Table 2 shows the behavior of the consumer sectors in terms of percentage of companies report their biodiversity policies under each sector category and percentage among the total 500 companies in the context of biodiversity policy adoption. There are two major categories of businesses like consumer goods and consumer services. Almost all the companies in the consumer goods sector have their own biodiversity protection policy. However, a very few companies in the consumer service sector have biodiversity policy. Reason behind such dismal level of performance could be attributed to their respective business nature of having no or very limited interaction with the nature and environment directly.

[Table 2]

Table 3 shows the behavior of the industrial sector in terms of percentage of companies report their biodiversity policies under each sector category and percentage among the total 500 companies in the context of biodiversity policy adoption. Unlike consumer services sector, industry sector has much more biodiversity protection policies as majority of the companies listed under this category have direct interaction with the environment. A few cases have been noticed in this category like real estate companies. They are non-starters yet in terms of adopting any biodiversity protection policy though they have direct impact on land and land use change and its corresponding effect on environment and local ecology.

[Table 3]

Table 4 shows the behavior of the service sector in terms of percentage of companies report their biodiversity policies under each sector category and percentage among the total 500 companies in the context of biodiversity policy adoption. The service sector includes the healthcare, finance and technology businesses together. As a matter of fact, the financial sector has much wider environmental policies including biodiversity protection compared to the other two sectors. Technology and business sector and the healthcare sector are not that progressive to adopt biodiversity protection policy which could be attributed to their business nature which is not directly involved with the environment and ecology.

[Table 4]

3.2 Assessment of the Fortune 500 companies' biodiversity policy responsiveness

We discussed earlier that most of the Fortune 500 companies do not systematically record their activities regarding biodiversity conservation and mitigation; therefore, collecting information on biodiversity-related investments was difficult. These data limitations therefore prompted the use of revenue as a normative indicator of the companies' expected behavior. In simple we assumed that if the company has higher revenue, then it is expected that they would be well organized in all of its planning and policies including the policies related to biodiversity. Ciocirlan and Pettersson (2011) and Ahmed et.al. (2003) also argued that there is some positive correlation between revenue and companies' decision making process towards environmental protection. The assumption informing this logic is that higher revenue corresponds to a greater likelihood of working seriously on issues related to biodiversity and ecosystem services. Hence, revenue has been considered as one of the indicators in the study.

The Fortune 500 companies' annual and corporate social responsibility reports rarely mentioned monetary investments that were specifically for biodiversity protection. Mainly, we get the overall investment amount for the purpose of overall environmental protection purposes including usage of renewable energy, water resource reservation, climate change, ecosystem services etc. In some cases, separate investment components are mentioned for climate change protection but not for biodiversity protection. In addition, we used the companies' revenue data mainly to determine a company's economic position and to rank the companies financially. We study the companies' policies and activities regarding the biodiversity protection separately. In this respect, the companies' revenues and contributions towards biodiversity protection are unrelated.

Figure 1 below indicates the link between the companies' revenues and their activities in relation to biodiversity protection. Our initial assessment shows that companywide acceptance of biodiversity policies is heterogeneous, although nearly all Fortune 500 companies maintain a global presence that is as broad as their geographical operational presence. The company's revenue is critical in determining the relative ranking on the Fortune 500 list. We hypothesize that such a revenue ranking method would influence the companies' responsible behavior towards society and the environment. The incorporation of a proper biodiversity protection policy in the overall corporate policy is one indicator for such behavior. Our result shows that the correlation between revenue ranking and biodiversity policy adoption is 0.42, which indicates that high-revenue-earning companies on the Fortune 500 list are not necessarily concerned about their biodiversity impact and corresponding measures. Fig. 1 illustrates the relative ranking of different subsectors based on their revenue, acceptance of biodiversity policies and the percentage of companies within a sector with specific biodiversity policies.

[Insert Figure 1]

3.3 Comparison of risk, revenue and mitigation policy measures of the Fortune 500 companies' and their biodiversity conservation policies

In this section, we first analyze the activities and reporting schemes of the major companies within each sector from Table 1, mainly to identify the current status of their biodiversity risk exposure.

We also analyze the companies by sector according to their revenue and specific adoption of biodiversity-related policies. Therefore, we consider mainly those companies that have the highest revenues in their sector and specific biodiversity-related policies. We discuss a few well-known companies that may not have a specific biodiversity policy but are

involved in unique biodiversity conservation activities, e.g., McDonald's (consumer service sector) marketing strategy.

The sectors discussed below were sequentially selected according to their sector biodiversity policy adaptation ranking.

Utilities

In the utility sector (electricity/gas/water), the business risks from biodiversity loss rank 2 (out of 6), and approximately 70% of the companies have specific biodiversity policies. This sector is ranked first in biodiversity policy acceptance, eighth in revenue and second in biodiversity risk. These rankings indicate that the utility sector, although low in revenue, is highly active in adopting protective measures because of its high risk of exposure to biodiversity loss. In this sector, the highest ranked company Dominion Resources has a clear biodiversity policy with specific measures for aquatic life protection, avian protection, rare plant protection and wildlife protection. Another high earning company, Southern, promotes the biodiversity conservation of its own land and partners with others in programs including Power of Flight, Longleaf Legacy and Five Star Restoration. Edison International specifies a clear biodiversity policy for vegetation and an integrated pest management plan. Pepco Holding's biodiversity policy includes wetlands delineation, threatened and endangered species identification, forest stand delineation, oyster bed and essential fish habitat assessments and an aquatic survey.

Primary industries

Approximately 90% of companies in the mining and crude oil production (MCP) sector report their biodiversity protection activities and policies in their CSR report. For example, Occidental Petroleum clearly mentions their biodiversity & habitat preservation policy and goals; Apache notes its conservation policy for wetland and wildlife.

Seventy percent of petroleum refining (PR) companies reported biodiversity policies. ExxonMobil, which is a highly ranked company in terms of revenue, claims that their sites incorporate biodiversity protection to limit the impact on sensitive areas. Their mitigation actions include participating in initiatives to enhance the wildlife and habitat attributes of their properties as well as modifying engineering design, construction and operating practices to protect particular species and sensitive habitats. Marathon Oil is certified by the Wildlife Habitat Council.

Fifty-two percent of chemical companies and 50% of metal companies report their biodiversity protection activities and policies in their CSR report. For example, Alcoa's biodiversity policy states that the successful operation of their mines, even in sensitive native

ecosystems, must avoid any impact on protected species and should follow targeted values to re-establish complex ecosystems. Although the top chemical company Dow Chemicals invests in various biodiversity protection activities, it offers no declarations of biodiversity policies in its CSR report. PPG Industries has a biodiversity policy for wildlife protection activities, whereas Ashland mentions a biodiversity policy for water bodies.

Among all the energy companies, 38.5% report biodiversity policies. For example, Constellation Energy and the Baltimore Gas and Electric Company (BGE) are collaborating to apply an Integrative Vegetation Management approach to their sites that involves the targeted use of environmentally benign herbicides to remove tall-growing, woody vegetation; in addition to complying with reliability requirements, this biodiversity policy reduces competition from invasive and undesirable plants that crowd out native and more beneficial plants.

Consumer Goods

Approximately 40% of companies in the food production (FP) sector clearly report their biodiversity policies, especially in CSR reports. In this sector, the company that generates the highest revenue, Archer Daniels Midland, is working to create a sustainable supply chain for palm oil in which one criterion is species conservation; However, this company only has general biodiversity policies for palm oil and soy production. Tyson Foods, which lacks business activities in or adjacent to legally protected biodiversity hot spots, does not describe its policy and activities related to biodiversity.

Among food consumer product (FCP) companies, approximately 50% have biodiversity policies. Major companies in this sector such as PepsiCo, Sara Lee, General Mills, and Kellogg include biodiversity policies for their agricultural supply chain initiatives. Sara Lee implements a biodiversity policy mainly in its coffee production and enhances the global multi-stakeholder initiative that functions to increase the sustainability in the mainstream coffee sector. General Mills commits to responsibly sourcing palm oil by ensuring that its purchases are not associated with rainforest deforestation. In contrast, a few companies such as Hershey have no formal program or strategy for managing their biodiversity impacts and claim that they presently do not significantly impact biodiversity levels.

Approximately 80% of household and personal products (HPP) companies have specific biodiversity policies. Major companies including P&G, Kimberly-Clark, Colgate-Palmolive and Avon Products consider biodiversity to be an important environmental indicator of their business operations. Avon Products and Kimberley–Clark clearly report on biodiversity indicators in their global reporting initiative (GRI). In its CSR report, Avon Products declares its full support for forest management practices that protect biodiversity and ecosystem

integrity, whereas Kimberly–Clark mentions its activities on habitat protection and restoration in the GRI.

Only 16% of beverage companies have biodiversity protection policies. Pepsi Bottling is the only company that mentions biodiversity policy in its sustainable agriculture principles. Only 18% of motor vehicle and parts manufacturing (MVP) companies have specific biodiversity policies. Among them, only General Motors indicates its volunteer-based efforts to preserve its community's biodiversity.

Companies in the forest and paper products (FPP) sector have specific biodiversity policies. For example, International Paper, Weyerhaeuser and Boise Cascade Holdings hold certifications including for forest management, fiber procurement, chain of custody certification such as FSC, the sustainable forestry initiative (SFI), the Brazilian forest certification standard (Cerflor) and the American Tree Farming System (ATFS) certification. In their paper procurement policy, most of these companies seek biodiversity-certified companies throughout the supply chain and are engaged in various biodiversity-related activities such as the conservation of biodiversity hotspots, major tropical wilderness areas and threatened and endangered species.

The miscellaneous sector contains three fortune 500 companies, and only one company, 3M, mentions its biodiversity policy; it claims that preserving and enhancing biodiversity constitutes an important aspect of its environmental sustainability strategy. In addition to activities such as maintaining and protecting sustainable forest land and preserving water quality in critical areas, 3M's main concern is to create and fund "new ways to keep wild areas wild".

In subsectors such as furniture, apparel, and home equipment & furnishings (HEF) industries, no companies have policies related to biodiversity and ecosystems, probably because they create less impact on biodiversity and are affected less by changes in biodiversity.

In the building materials & glass (BMG) sector, only one company, Owens Corning, has a specific policy related to biodiversity. When Owens Corning evaluates potential properties and operations for acquisition purposes, environmental consultants review the potential property and surrounding areas to assess existing environmental damage, including biodiversity loss and stressed vegetation; when selecting operational sites, they consider world heritage and biosphere sites, including forests, mountains, lakes, deserts, monuments, buildings and cities considered by United Nations Educational Scientific and Cultural Organization (UNESCO) to be of special cultural or physical significance.

In the toys and sporting goods (TSG) sector, only Mattel clearly mentions a biodiversity policy, primarily for paper procurement.

Industrial

The industrial sector (construction, aerospace components) ranks fourth in terms of the risk from biodiversity loss; 27.8% of the companies report on their biodiversity policies and activities. This sector ranks fifth in revenue generation. In this sector, subsectors such as wholesalers of electronics and office equipment (WOE), railroads, electronics and electrical equipment (EEE), transportation equipment (TE) and real estate (RE) have 0% biodiversity policy acceptance. In the homebuilders' category, 27.3 % of companies report biodiversity concern and policies; for example, Lennar mentions the preservation and enhancement of wetlands and wildlife habitat in its CSR report.

In the oil and gas equipment and services (OGE) subsector, 80% of the companies have environmental policies related to biodiversity. Baker Hughes mentions its biodiversity policy and action plan in relation to its GRI report on sustainable technology and environment protection.

In the computer peripherals (CP) subsector, 66.7% of companies report on their biodiversity protection policy. Although companies such as EMC claim their impact on biodiversity is largely indirect, they also claim to use a systems approach to environmental sustainability (including biodiversity) to drive their business.

Sixty companies in the engineering and construction (EC) subsector report on their biodiversity policies. In adopting sustainability as a goal, Fluor, the top EC company, uses the "Triple Bottom Line" model, which considers the protection of wildlife habitats and biodiversity as environmental stewardship.

In the scientific photo control equipment (SPC) subsector, one of the three companies (33.3%), Eastman Kodak, reports a biodiversity and natural habitat policy. In the medical products & equipment (MPE) subsector, 2 out of 5 companies (40%) reported a biodiversity activity and policy in their CSR reports. In addition, 33.3% of pipeline-manufacturing companies and 42.9% of semiconductor and other electronic component manufacturing (SEC) companies reported biodiversity policies.

In the aerospace and defense (AD) subsector, only one of the 10 topmost companies, Boeing, has a biodiversity policy in its CSR report, which pledges to consider only renewable fuel sources that have a minimal biodiversity impact. In the computers & office equipment (COE) category and in the network and other communications equipment (NCE) category,

37.5% and 33.3% of the companies, respectively, report biodiversity consciousness and policies. In the industrial & farm equipment (IFE) category, only 7% of the companies, i.e., Deere, mentions a concern for biodiversity protection.

Financial institution

Approximately 83% of the securities companies (5 of 6) report biodiversity consciousness and policies in their CSR or sustainability reports. Goldman Sachs uses biodiversity policies for a major service related to market-based solutions for environmental issues. Morgan Stanley expresses concern about diversity, probably because its environmental policy statement is developed by its major business units in consultation with external stakeholders.

Although companies in the insurance for life and health (mutual) (ILHM) category did not report policies related to biodiversity protection, 1 of the 2 insurance P & C (mutual) (IPCM) companies, State Farm Insurance, mentions biodiversity and ecosystem protection concerns in the environmental responsibility section of its CSR; State Farm states that its environmental responsibility covers conservation issues beyond land and wildlife and that it considers the preservation of biodiversity and fragile ecosystems to be integral to this responsibility.

Savings institutions (SI) and financial data services (FDS) companies do not report on these issues but may be considering their indirect impact. One of 18 (i.e., 5.6%) insurance of P & C (stock) (IPCS) companies and 20% (2 out of 10) of insurance of life & health (stock) (ILHS) companies report biodiversity-related concerns and policies. For example, the ILHS company MetLife reports on its biodiversity policy and its biodiversity protection activities for the New York Botanical Garden.

Among diversified financial (DF) companies and commercial banks (CB), 33.3% and 23.8%, respectively, report biodiversity policies. The commercial bank JPMorgan Chase reports its plantation and natural habitat protection policies and activities. Many commercial banks may not have specific biodiversity or ecosystem protection policies but mention biodiversity and forest conservation in their paper procurement policy.

Consumer services

In the consumer services sector, biodiversity risk ranks fifth, aggregated biodiversity policy acceptance ranks sixth, and aggregated revenue generation ranks third. Companies in the general merchandiser (GM), airline, automotive retailing and services (ARS), wholesalers: diversified (WD), temporary help (TH), transportation and logistics (TL), and trucking & truck leasing (TTL) subsectors do not report biodiversity consciousness or policies

because they have no direct impact on biodiversity levels. In the specialty retailers (SR) subsector, only 8.3% of companies have biodiversity policies, which primarily relate to their forestry policy and paper & wood procurement policy.

In the food and drug stores (FD) subsector, 20% of companies report biodiversity policies. For example, through research and engagement with the relevant stakeholders in the food industry, Safeway adopts a biodiversity protection policy for food standards. In addition, 33.3% of entertainment companies report on biodiversity protection policies. Time Warner relates its biodiversity policy mainly to forest management policy by supporting suppliers with proper forest certification. One out of two (50%) mail, package and freight delivery (MPF) companies, FedEx, reports biodiversity concern and policies,particularly in relation to reforestation.

Among the packaging and container (PC) companies, 28.6% report biodiversity policies. The topmost company, Smurfit-Stone Container, reports biodiversity policies in relation to sustainable forestry; 25% of wholesalers: food and grocery (WFG) companies and 50% of food services (FS) companies report biodiversity policies. The well-known food services company, McDonald's may not have direct biodiversity or forestry policies, but its "Endangered Animals Happy Meal" effectively relates marketing to biodiversity. The food services company Starbucks' has a biodiversity policy for coffee production with organic and traditional shade-growing agricultural methods that protect the forest's birds and biodiversity [6]

In the hotels, casinos and resorts (HCR) subsector 40% of the companies report biodiversity policies. Hotel Marriott International has clear policies on biodiversity protection primarily in terms of forest management, as it considers rain forest preservation to be an important policy. Twenty-five percent of publishing and printing (PP) companies and 50% of waste management (WM) companies report biodiversity policies. For the publishing and printing company R.R. Donnelley & Sons, biodiversity conservation and forest ecosystem protection constitute one of their sustainability principles. The waste management company Allied Waste Industries' biodiversity-related policies and activities concern wildlife habitat and wetland habitat conservation.

Health care

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[6] Studies show that species richness of all ants and birds and of forest ant and bird species are lower in most coffee agro ecosystems (where intensified coffee management process is followed) than in natural forests. But rustic coffee which are grown under native forest canopies/ natural shade trees have equal or greater ant and bird richness than nearby forests. Thus rustic coffee production is better for maintaining biodiversity level (SM Philpott and WJ Arendt et al., 2008)(http://www.ncbi.nlm.nih.gov/pubmed/18759777). Starbucks is also adopting biodiversity policies to follow traditional rustic coffee production system which utilizes native forest canopies, and by these ways they are trying to decrease the biodiversity loss.

In the health-care sector (pharmaceuticals, biotechnology, healthcare providers), the risk of biodiversity loss and revenue generation rank 3rd and 6th, respectively. Only 13.3% of the sector, however, expresses a clear biodiversity policy, and only pharmaceutical companies report clearly about their biodiversity policies and activities. Companies from the wholesalers: health care (WHC), health care: insurance & managed care (HIM), health care: pharmacy and other services (HPO) and health care: medical facilities (HMF) subsectors do not have specific policies regarding biodiversity. The topmost pharmaceutical companies such as Johnson & Johnson are considerably active in biodiversity protection; Johnson & Johnson specifies that it has more than 55 conservation projects underway around the world, and 66% of these aim to enhance or conserve off-site biodiversity. Some major pharmaceutical companies, such as Pfizer and Wyeth (now Pfizer), include biodiversity protection in their water policy.

Technology & business services

In Technology and business services sector, business risks due to biodiversity loss is the lowest (rank 6) among the sectors discussed while revenue generation rank is 7 and only 5.2 % companies in these sector have clear biodiversity policy.

The advertising and marketing (AM), telecommunications, computer software (CS), diversified outsourcing (DO) and payroll services (PS) sectors have no biodiversity policies or protection activities. In the information technology services (IT) subsector, only 1 of 5 (20%) of the companies, Affiliated Computer Services (a Xerox company), mentions a biodiversity policy, which is mainly incorporated into its forest policy. In the internet services and retailing (ISR) subsector, only 1 of 6 (16.7%) of the companies, Google, mentions biodiversity concerns and policies.

3.4 Comparison of revenue, risk and action among the FORTUNE 500 companies

To analyze the companies' biodiversity-related policies within each sector, we first identified the companies' risk perception in terms of business activities and then converted them into risk profiles based on risk characteristics. This analysis provides twelve different types of risk that a company can face when their operations negatively impact biodiversity and ecosystems. During the content analysis of the individual companies' policies, we determined that companies mainly attempt to conceal these risks. In most cases, the policies appear to focus narrowly on immediate targets. Based on the twelve-category risk spectrum, we have identified the level of risk exposure for each sector (TEEB Report for Business 2010 (Chapter 4), Economic Evaluation of Environmental Impacts of Asian Development Bank) and compared risk profiles to respective revenue and biodiversity policy adoption rankings.

[Insert Figure 2]

Figure 2 shows the correlations between the three indicators used in this study, i.e., the biodiversity risk ranking, revenue ranking and biodiversity policy acceptance ranking. We have 8 sectors (Mining,/ Electricity / Financial among others) and three indicators like company revenue, biodiversity loss related risk and biodiversity policy adoption. For the revenue higher the rank number is higher the earning of companies. In context of risk, higher the rank number indicates that the sector is highly exposed to the risk related to loss of biodiversity. Similarly, for the indicator of policy adoption, higher the rank number means sector is highly aware of the importance of biodiversity and taking necessary actions to protect biodiversity by taking company level policies and vice versa. Since there is no single indicator or index to measure the companies in the context of biodiversity impact, we had to create certain parameters which are most likely indicating the targeted performance of the companies.

The financial sector, which includes banks and insurance companies, has the highest revenue levels. Although this sector demonstrates considerably low levels of biodiversity-related policy adoption, it also has lower levels of risk related to biodiversity loss. Furthermore, the utility sector, which includes electricity, water and gas companies, has the lowest revenue levels but is ranked high in the areas of risk related to biodiversity loss and the adoption of specific biodiversity mitigation policies. Thus, these indicators exhibit little or no correlation. Using these rank and risk characteristics for the 8 different sectors, we analyzed each sector in terms of its biodiversity loss risk, economic performance and level of biodiversity protection policy acceptance.

4. Discussion and Conclusion

This study illustrates that in most cases, biodiversity loss and its related risks to businesses are not fully addressed by company policies. Therefore, despite bearing high levels of biodiversity risk exposure and related business risks, companies have yet to adopt specific biodiversity policies for day-to-day activities. A clear gap is found in the lack of a proper assessment tool for estimating the impact of biodiversity losses in terms of financial, social and environmental measures. Unless companies are aware of their economic impact on the loss of biodiversity and understand the benefits of risk-mitigating measures in terms of finance or reputation, the companies are highly unlikely to seriously address biodiversity. It has been reported by the World Economic Forum that globally only 27% of the companies are somewhat concern about the loss of biodiversity and its related impact on the business. The major reason of such poor response is found to be very slow impact of biodiversity loss on business activities (WEF 2010).

In contrast to the responses related to climate change, those related to biodiversity loss are not significant relative to the scale of business operations. However, the increased expression of concern by the companies for wildlife protection activities and related ecosystem conservation issues indicates an improved general awareness of these issues. In most cases, the companies' biodiversity policies are concealed within general environmental protection measures and CSR activities; as a result, these actions lack the systematic organization that can benefit companies and their consumers. The results of our study indicate that companies that directly generate biodiversity loss are more likely to formally specify their concern for biodiversity through reporting. This effect is probably a consequence of the public perception of company liability. Our analysis of company reports and published documents reveals a clear lack of direction and commitment to addressing the problem of biodiversity loss. In fact, the reporting of biodiversity-related activities is rare even in the GRI guidelines, which exacerbate the impact of biodiversity loss globally. In the Economics of Ecosystems and Biodiversity report 2010, it has been further mentioned that the companies having direct interaction with the ecosystems like tobacco, food and beverage companies are more proactive in the biodiversity conservation and protection measures. (TEEB 2010).

In summary, the major findings are as follows:

1. Companies' revenue profiles do not significantly affect their acceptance of specific biodiversity-related policies. Large companies thus have yet to act responsibly with respect to biodiversity protection.
2. Companies' business activity profiles significantly influence their decisions to adopt biodiversity protection policy and measures. Therefore, unless companies consider the impact of biodiversity loss on their business activities, it may be difficult to encourage them to adopt mitigation actions.
3. Companies' business risk profiles might influence their acceptance of biodiversity-related policies, although minimal initiative has been taken.

This study shows that companies in the utility sector, which bears a high operational impact on ecosystems, rank high in the adoption of specific biodiversity mitigation policies despite generating low revenues, whereas the financial sector ranks lower on biodiversity protection policy adoption and the risk of biodiversity loss even though it generates high revenues. In primary industries, the revenue generation is lower, but the risk of biodiversity loss and thus the rate biodiversity mitigation policy adoption is comparatively higher.

However, most Fortune 500 companies with direct biodiversity-related policies prefer mitigation hierarchy measures that are cost-effective, less tedious and easy to understand

and implement. Practices designed to reduce the impact of business development on biodiversity are known as compensatory mitigation (Madsen et al. 2010). Few countries are in the early stages of the adoption or investigation of compensatory mitigation, but in most geographical regions, compensatory mitigation is developed or developing around different economic, political, institutional and cultural circumstances that give rise to a variety of programs (Madsen et al. 2010). However, no corresponding frameworks are available to guide business sectors in setting up such a mitigation hierarchy. Consequently, we recommend a three-step approach for preparing a sector-specific mitigation hierarchy framework to assess and mitigate the damage caused by ecosystem and biodiversity losses. Initially, such a framework at the level of the sector rather than the company will be important because more detailed information and data are required for a company-specific framework. Such a sector-specific framework can be developed by companies within a particular sector by collecting the relevant preparatory information.

Step-I : Prepare a revenue risk profile for all member companies within the sector to reflect the current and future positions based on various external factors such as market risk and regulatory risk.

Step-II: Prepare the sector's business process risk profile based on a life cycle assessment, which will identify potential sources or causes of biodiversity and ecosystem losses. This step can also factor in future technological changes, which might alter companies' business processes and activity profiles and their corresponding impact.

Step-III: Prepare a detailed sector-wide business risk mapping based on market research, which should be linked to each step of the business process. For example, if pesticides are a significant source or cause of biodiversity loss for a particular sector, then all sources of pesticides in all business activities should be consolidated and mapped against the nature of their risk impact, e.g., reduced productivity.

A limitation of this paper is our lack of attention to the details concerning the companies' actual implementation of work related to ecosystem services and biodiversity protection; we are thus unable to surmise much beyond popular reporting. In addition, we primarily used publicly available information and data to evaluate the companies' policies for combating biodiversity-related losses; our results are thus indicative rather than definitive in nature. Future research can examine each company's activities in greater detail.

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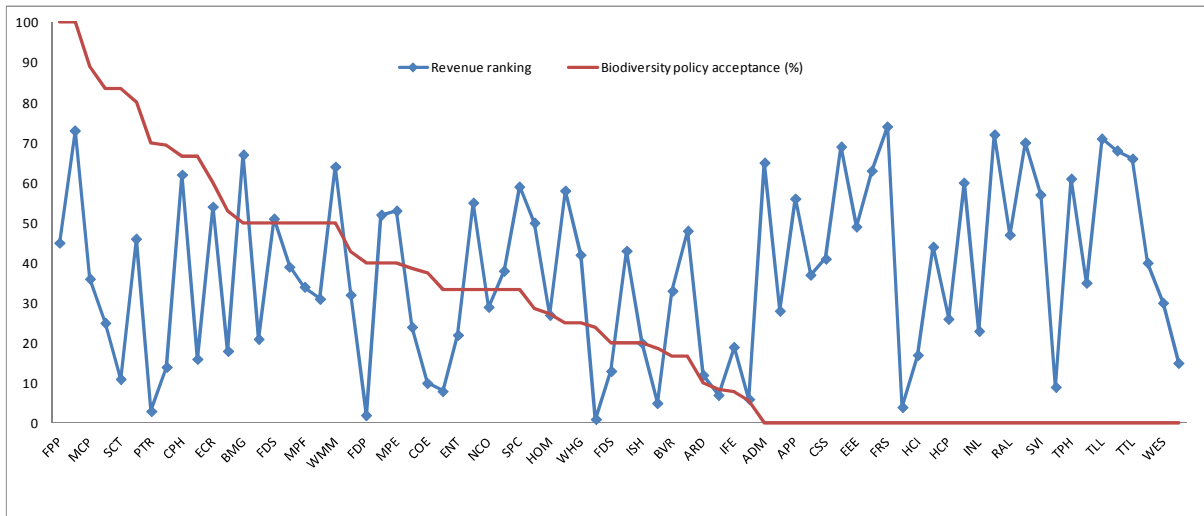
Fig. 1. Comparative ranking of revenue and percentage of biodiversity policy acceptance of the Fortune 500 companies

Note: Sector abbreviation detail: Forest & Paper Products = FPP; Toys, Sporting Goods= TSG; Mining, Crude-Oil Production = MCP Household and Personal Products = HPP; Securities = SCT; Oil and Gas Equipment, Services = OGS; Petroleum Refining = PTR;   Utilities: Gas & Electric = UGE;   Computer Peripherals= CPH; Pharmaceuticals = PHR; Engineering, Construction = ECR; Chemicals= CHM; Building Materials, glass = BMG; Food Consumer Products= FCP; Food Services = FDS; Insurance: P & C (mutual)=ISM; Mail, Package, Freight Delivery=MPF; Metals=MTL; Waste Management =WMM; Semiconductors and Other Electronic Components =SCE; Food Production=FDP; Hotels, Casinos, Resorts=HCR; Medical Products & Equipment=MPE; Energy =ENG; Computers, Office Equipment=COE; Diversified Financials =DFS; Entertainment =ENT; Miscellaneous= MSC; Network and Other Communications Equipment=NCO; Pipelines=PIP; Scientific, Photo, Control Equipment=SPC; Packaging, Containers =PKG; Homebuilders=HOM; Publishing, Printing=PPT; Wholesalers: Food and Grocery=WHG; Commercial Banks = CBK; Food & Drug Stores=FDS; Information Technology Services=ICT; Insurance: Life, Health (stock)=ISH; Motor Vehicles & Parts=MVP; Beverages=BVR; Internet Services and Retailing =ISR; Aerospace and Defence =ARD; Specialty Retailers=RET; Industrial & Farm Equipment= IFE; Insurance: P & C (stock) =ISS; Advertising, Marketing=ADM; Airlines =ARL; Apparel =APP; Automotive Retailing, Services=AUT; Computer Software= CSS; Diversified Outsourcing= BPO; Electronics, Electrical Equipment= EEE; Financial Data Services= FDS; Furniture =FRS; General Merchandisers=GMD; Health Care: Insurance & Managed Care= HCI; Health Care: Medical Facilities =HCM; Health Care: Pharmacy and Other Services= HCP; Home Equipment, Furnishings=HEF; Insurance: Life, Health (mutual)=INL; Payroll Services=PRS; Railroads=RAL; Real Estate=RES; Savings Institutions=SVI; Telecommunications=TEL; Temporary Help=TPH; Tobacco=TBC; Transportation and Logistics =TLL; Transportation Equipment=TRE; Trucking, Truck Leasing=TTL; Wholesalers: Diversified= WHS; Wholesalers: Electronics and Office Equipment = WES; Wholesalers: Health Care= WHS
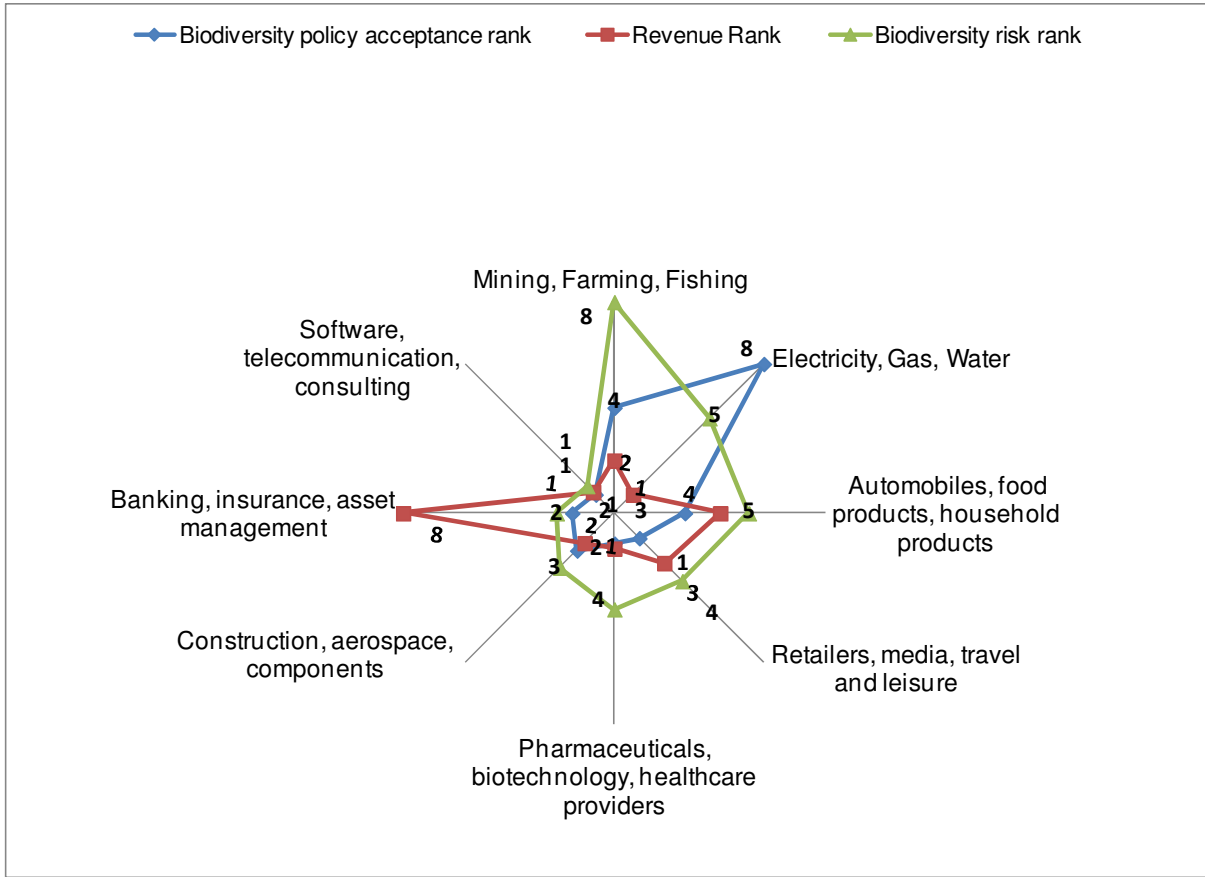
Fig.2. Comparison between Business Risk due to Biodiversity Loss, Policy Acceptance and Fortune 500 Revenue Rank

Table 1 : Assessment of primary and utility sector's biodiversity policy

Sectors	Subsectors	No. of Companies per sector	% of companies among F500	% of companies with Biodiversity Policies	Impact on biodiversity level and objectives to adopt specific policies on biodiversity
Primary Industries	Mining, Crude-Oil Production (MCP)	9	1.8%	90%	The extraction of oil is responsible for the deforestation, degradation, and destruction of lands across the globe. The oil extraction process also releases toxic drilling by-products into local rivers, while broken pipelines and leakage result in persistent oil spillage. The construction of roads for accessing remote oil sites opens wild lands to colonists and land developers. Due to these serious impacts created their production process, 90% MCP companies adopt direct policies on biodiversity protection.
	Petroleum Refining (PR)	10	2.0%	70%	Gas flaring during oil refining produces highly poisonous chemicals which creat severe negative impacts to the biodiversity. To mitigate these impacts, the 70 % petroleum refining companies adopt direct policies to protect biodiversity and ecosystems.
	Chemicals	17	3.4%	52%	52% Chemical companies adopts biodiversity protection activities and policies to mitigate impacts on protected species and to reestablish complex ecosystems as their production process / operation are held in mines existed in the sensitive native ecosystems.
	Energy	13	2.6%	38.5 %	While constructing new power plants (green field projects), biodiversity level gets hampered and sometimes, restoration of the forest in a different place is required with necessary relocation of species living in the forest. Thus 38.5% energy companies adopts biodiversity policies
	Metals	8	1.6%	50%	Indigenous forest and it's flora and fauna is affected during the mining activities. Rehabilitation of indigenous people from the mining area is also important for the metal industry. After the mining, site restoration plays major role in terms of conservation and protection of the biodiversity. Thus 50% Metal companies take up biodiversity policy in their CSR activities.
	Tobacco	2	0.4%	0%	None among the two tobacco companies have any specific biodiversity policies. But they mention about some activities related to wetland protection as Tobacco industry's long-term success relies on sustainable sources natural resources, though they don't create significant impact on biodiversity level.
Utilities	Utilities: Gas & Electric	26	5.2%	70%	During the construction of new power plants for electricity production, biodiversity protection of the local areas is important. Sometimes, restoration of the forest is required with necessary relocation of species living in that forest. Route selection for the gas reserve and distribution is also important as the routs may be gone through the sensitive areas (e.g., Indigenous Peoples, rich biodiversity, old growth forest, a conservation unit etc.). Thus 70% Utility companies adopt biodiversity protection policy.

Table 2: **Assessment of consumer sector's biodiversity policy**

Sectors	Subsectors	No. of Companies per sector	% of companies among F500	% of companies with Biodiversity Policies	Impact on biodiversity level and objectives to adopt specific policies on biodiversity
Consumer Goods	Food Production (FP)	5	1.0%	40%	Around 40% companies in the food production (FP) sector reports clearly about their biodiversity policies. Main objective behind it is to create a sustainable food supply chain.
	Motor Vehicles & Parts (MVP)	15	3.0%	18%	Only 18% motor vehicle and parts manufacturing (MVP) companies have specific biodiversity policies as they don't create much impact on biodiversity level through their operation process.
	Food Consumer Products (FCP)	14	2.8%	50%	Among the food consumer products (FCP) companies, around 50% have policies on biodiversity. The objective is mainly to maintain environment friendly agricultural supply chain.
	Household and Personal Products (HPP)	6	1.2%	80%	For the household and personal products (HPP) companies, around 80% have specific policies related to biodiversity as they consider biodiversity as important environmental indicator for their business operations.
	Beverages	6	1.2%	16%	Only 16% beverages companies have policies on biodiversity protection. Though this sector doesn't create much impact directly on the biodiversity level, the only company in this subsector, i.e, Pepsi Bottling takes up biodiversity policy as sustainable agriculture principles.
	Forest & Paper Products (FPP)	3	0.6%	100%	All 3 companies in the forest and paper products (FPP) sector have specific biodiversity policies and they take up different certification. i.e, FSC etc. as the major fortune 500 companies in U.S look for biodiversity certified companies in the supply chain for their paper procurement policy
	Miscellaneous	3	0.6%	33%	Only one company, 3M, mentions about its biodiversity policy as their objective is to preserve and enhance biodiversity as an important part of their environmental sustainability strategy.
	Apparel	4	0.8%	0%	No company has biodiversity policy as their business process don't create any direct impact on biodiversity level.
	Home Equipment, Furnishings (HEF)	3	0.6%	0%	Biodiversity policy not adopted.
	Building Materials, Glass (BMG)	2	0.4%	50%	Only one among two companies Owens Corning has biodiversity policy. The objective is to take care of environmental damage including biodiversity loss and stressed vegetation while evaluating potential properties and operations for acquisition purposes.
	Toys, sporting goods (TSG)	1	0.2%	100%	Here, only Fortune 500 Company Mattel has biodiversity policy regarding their paper procurement process in the supply chain.
	Furniture	1	0.2%	0%	Biodiversity policy not adopted.
Consumer Service	General Merchandisers (GM)	10	2.0%	0%	Biodiversity policy not adopted.
	Specialty Retailers (SR)	24	4.8%	8.3%	Only 8.3% companies have biodiversity policies, mainly related to forestry policy and paper & wood procurement policy.
	Food & Drug Stores (FD)	10	2.0%	20%	Here, 20% companies has biodiversity protection policy related to food standards through research and engagement with the relevant stakeholders in the food.
	Entertainment	6	1.2%	33.3%	33.3% entertainment companies' reports on biodiversity protection policies as tourism can generate revenue to protect and preserve biodiversity and environment especially in developing countries. Besides preserving the

					environment, but profits have a greater potential to reach local and rural communities, compared to other sectors.
Consumer Service	Airlines	7	1.4%	0%	Biodiversity policy not adopted.
	Mail, Package, Freight Delivery(MPF)	2	0.4%	50%	50% (1 out of 2) companies i.e., FedEx reports on their biodiversity concern and policies, mainly for reforestation.
	Automotive Retailing, Services (ARS)	8	1.6%	0%	Biodiversity policy not adopted.
	Wholesalers: Diversified (WD)	9	1.8%	0%	Biodiversity policy not adopted.
	Wholesalers: Food and Grocery (WFG)	4	0.8%	0%	Biodiversity policy not adopted.
	Packaging, Containers (PC)	7	1.4%	0%	Biodiversity policy not adopted.
	Food Services(FS)	4	0.8%	0%	Biodiversity policy not adopted.
	Hotels, Casinos, Resorts (HCR)	5	1.0%	0%	Biodiversity policy not adopted.
	Publishing, Printing (PP)	4	0.8%	0%	Biodiversity policy not adopted.
	Temporary Help (TH)	2	0.4%	0%	Biodiversity policy not adopted.
	Waste Management(WM)	2	0.4%	0%	Biodiversity policy not adopted.
	Transportation and Logistics (TL)	2	0.4%	0%	Biodiversity policy not adopted.
	Trucking, Truck Leasing (TTL)	2	0.4%	0%	Biodiversity policy not adopted.

Table 3: Assessment of Industrial sector's biodiversity policy

Sectors	Subsectors	No. of Companies per sector	% of companies among F500	% of companies with Biodiversity Policies	Impact on biodiversity level and objectives to adopt specific policies on biodiversity
Industrials	Aerospace and Defense (AD)	10	2.0%	10%	One out of 10 companies has a biodiversity policy in its CSR reports which considers only renewable fuel sources that minimize biodiversity impacts.
	Computers, Office Equipment (COE)	8	1.6%	37.5 %	37.5% companies take up biodiversity policy with main emphasis on forest stewardship for their paper procurement.
	Industrial & Farm Equipment (IFE)	13	2.6%	7%	7% companies takes up biodiversity policy considering biodiversity as an important environmental indicators.
	Homebuilders	11	2.2%	27.3 %	27% companies adopt biodiversity policies to show that ecology and biodiversity are considered at the design and planning stage, and to describe how ecology is managed on site.
	Network and other Communications Equipment (NCE)	6	1.2%	33.3%	In the coming years the network will be the key technology enabler to monitor, manage, and reduce environmental impacts and to deliver solutions for energy and resource management, and will apply these solutions for their own operations. Thus 33.3% companies adopt biodiversity policy.
	Wholesalers: Electronics and Office Equipment (WOE)	7	1.4%	0%	Biodiversity policy not adopted.
	Semiconductors and Other Electronic Components (SEC)	7	1.4%	42.9%	Different organic compound and metals used by the WOE manufacturers have carcinogenic effect and also act as neurotoxicants which can affect biodiversity level and ecosystem severely. To mitigate these impacts 42.9% companies adopt policy related to biodiversity protection.
	Pipelines	6	1.2%	33.3%	Pipeline impacts on biodiversity could be measured by many ways. If a hydrocarbon reserve is located inside a "sensitive area" (e.g., Indigenous Peoples, rich biodiversity, old growth forest etc.), directional drilling can avoid damage to the sensitive area by drilling laterally as far as possible. To mitigate these impacts, 33.3% companies adopt biodiversity policies.
	Oil and Gas Equipment, Services (OGE)	5	1.0%	80%	80% companies mention their biodiversity policy and action plan in relation to the sustainable technology and environment protection. Route selection for the oil and gas reserve and distribution is very important in this regard, as the routs may be through the sensitive areas (e.g., Indigenous Peoples, rich biodiversity, old growth forest, a conservation unit etc.).
	Railroads	4	0.8%	0%	Biodiversity policy not adopted.
	Electronics, Electrical Equipment (EEE)	4	0.8%	0%	Biodiversity policy not adopted.
	Medical Products & Equipment (MPE)	5	1.0%	40%	2 out of 5 companies (40%) reported about their biodiversity activity and policy in their CSR reports. The connections between human health and a healthy environment are inseparable. That's the objective behind the MPE companies take up policies on biodiversity.
	Engineering, Construction (EC)	5	1.0%	60%	60 % EC companies report on their biodiversity policies mainly for the protection of wildlife habitats and the biodiversity protection as environmental stewardship.
	Scientific, photo, Control equipment(SPC)	3	0.6%	33.3%	One out of three SPC companies (33.3%), i.e., Eastman Kodak reports on its biodiversity and natural habitat policy for maintaining it's environmental stewardship.

	Computer Peripherals (CP)	3	0.6%	66.7%	66.7% companies with biodiversity policy claim that they have indirect impact on biodiversity, but they also claim to use system approach for environmental sustainability including biodiversity to influence their business.
	Transportation Equipment(TE)	2	0.4%	0%	Biodiversity policy not adopted.
	Real Estate(RE)	2	0.4%	0%	Biodiversity policy not adopted.

Table 4: Assessment of service sector's biodiversity policy

Sectors	Subsectors	No. of Companies per sector	% of companies among F500	% of companies with Biodiversity Policies	Impact on biodiversity level and objectives to adopt specific policies on biodiversity
Health Care	Wholesalers: Health Care (WHC)	5	1.0%	0%	Biodiversity policy not adopted.
	Pharmaceuticals	9	1.8%	67%	67% major pharmaceutical companies including Pfizer, Wyeth (now Pfizer) mentions about biodiversity protection policies under their water policy. These corporations are undergoing research in the rainforests for a variety of reasons. there is a great deal of pharmaceutical research going on in the labs of these particular companies, only 1 percent of all known plant and animal life have been examined for their medicinal potentials. So main objectives behind adopting biodiversity policy is to To discover new drugs to treat human diseases worldwide.
	Health Care: Insurance & Managed Care (HIM)	7	1.4%	0%	Biodiversity policy not adopted.
	Health Care: Pharmacy and Other Services (HPO)	5	1.0%	0%	Biodiversity policy not adopted.
	Health Care: Medical Facilities(HMF)	6	1.2%	0%	Biodiversity policy not adopted.
Financials	Diversified Financials (DF)	9	1.8%	33.3%	33.3% DF companies have biodiversity policy as their environmental liability though they don't create any impact on biodiversity directly.
	Commercial Banks (CB)	21	4.2%	23.8%	The commercial banks may not have direct policy for biodiversity or ecosystem protection policies but for their paper procurement policy in the supply chain, they mentioned about biodiversity and forest conservation.
	Insurance: P & C (stock) (IPC)	18	3.6%	5.6%	5.6% 18 IPC companies have policies on biodiversity mainly as their part of environmental stewardship as their business process doesn't create any direct impact on biodiversity level.
	Securities	7	1.4%	83 %	5 out of 6 securities companies' reports on their biodiversity consciousness and policies in their CSR or sustainability reports mainly for their major service related to the market-based solutions to environmental issues.
	Insurance: Life, Health (stock)(ILHS)	10	2.0%	20%	No but only 20% ILHS companies have policies on biodiversity as a part of environmental stewardship but their business process doesn't create any direct impact on biodiversity level.
	Insurance: Life, Health (mutual)	8	1.6%	0%	Biodiversity policy not adopted.

	(ILHM)				
	Insurance: P & C (mutual) (IPCM)	2	0.4%	50%	50% companies mentions about their biodiversity and ecosystem protection concerns in their environmental responsibility section of CSR though their business process doesn't have any direct impact on biodiversity level.
	Savings Institutions (SI)	2	0.4%	0%	Biodiversity policy not adopted.
	Financial Data Services (FDS)	4	0.8%	0%	Biodiversity policy not adopted.
Technology & business service	Advertising, Marketing (AM)	2	0.4%	0%	Biodiversity policy not adopted.
	Telecommunications	13	2.6%	0%	Biodiversity policy not adopted.
	Computer Software (CS)	2	0.4%	0%	Biodiversity policy not adopted.
	Information Technology Services (ITS)	5	1.0%	20%	20% ITS companies mentions about its biodiversity policy mainly in their forest policy their business process doesn't create any direct impact on biodiversity level.
	Internet Services and Retailing (ISR)	6	1.2%	16.7%	Only 16.7% companies (1 out of 6), i.e., Google mentions about its biodiversity concerns and policies as a part of their overall environment concern, but other companies don't have any policy as this business don't create any impact directly on biodiversity level.
	Diversified Outsourcing (DO)	1	0.2%	0%	Biodiversity policy not adopted.
	Payroll Services (PS)	1	0.2%	0%	Biodiversity policy not adopted.