Large-Scale Extractive Industry Scoping Study *Cambodia*

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Summary

Cambodia's mineral and hydrocarbon resources are largely untapped, but interest from foreign investors has recently increased, including exploration of bauxite deposits by BHP Billiton and Mitsubishi. Currently, extraction of gold and other hard minerals is exclusively small-scale and largely unregulated. Discovery of offshore oil reserves in 2005 has spurred additional investment and exploration, and oil production is estimated to begin by 2008. The prospect of a dramatic increase in government revenue has prompted a range of organizations to pursue the development of legal frameworks for revenue management and mechanisms for ensuring accountability and transparency.

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Sector Overview – Current and Prospective Extractive Industry Activity

Hard Minerals Sector

Cambodia currently has no large-scale extractive industry in hard minerals, and the mining sector contributed only 0.27% of the country's GDP in 2004.[1] However, during the last few years the Ministry of Industry, Mining, and Energy (MIME) has issued several exploration licenses to assess the commercial viability of mining iron ore, gold and other metallic minerals, bauxite, coal, and gemstones (Annex 1). While there is no comprehensive inventory of mining activities, interviews with mining companies and NGOs confirm that at this point, all mining is small-scale. Several Cambodian companies have acquired exploratory licenses but not utilized them, and sales of those concessions have reportedly increased recently due to warnings from the prime minister that idle concessions would be revoked. In addition, a few large international companies have begun exploratory work in Cambodia, such as Australia-based Oxiana, which operates the large-scale gold and copper Sepon mine in Laos. According to some reports, gold and iron ore mines are expected to begin production in the next few years,[2] while others predict that it will be 7-10 years before any large-scale production is underway. [3] In late 2006, BHP Billiton and Mitsubishi agreed to initial investments for a bauxite mine and alumina refinery in Mondolkiri province, and are currently in the exploratory phase.[4]

There are several reasons not to expect rapid growth in Cambodia's hard mineral sector in the short term. Obstacles to large-scale mineral extraction include the unexploded ordnance and land mines which remain from years of civil war, a corrupt and inefficient public sector, a shortage of skilled workers, and limited infrastructure capacity. However, success in developing a large-scale operation such as the bauxite project could encourage additional foreign investment.

Hydrocarbon Sector

In early 2005, a consortium of companies led by ChevronTexaco announced the discovery of oil in Block A, off the west coast of Cambodia (see maps in Annex III). In July 2006, an agreement was signed with the Cambodian National Petroleum Authority (CNPA) to begin drilling in Block A for additional test wells.[5] The results of those tests have not yet been announced. Some reports have estimated that production could begin within a year, while others suggest that oil output will be delayed until at least 2010.[6] Following Chevron's discovery, other offshore blocks have received increased interest from potential investors, and contracts have been signed for most of the other offshore blocks, with additional onshore blocks also under negotiation.

For a large portion of potential offshore territory known as the Overlapping Claims Area (OCA), development of Cambodian oil and gas resources has been slowed by disputes with Thailand over the right to grant concessions. The OCA is expected to have even greater reserves of gas and oil than the undisputed offshore blocks.[7] This conflict is currently being negotiated with the help of the Norwegian Petroleum Directorate (NPD), and there are discussions of joint exploration and

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[1] USGS –John C.Wu, "The Mineral Industries of Cambodia and Laos," U.S. Geological Survey Minerals Yearbook, <http://minerals.USGS.gov/minerals/pubs/country/2004/cblamyb05.pdf>

[2] Ibid.

[3] Oxiana interview, 8/07/2006.

[4] Chea Kimsan, "Priceless treasure or ticking time bomb?" The Cambodian Scene, March/April 2007.

[5] Kimsong, Kay and Adam Piore, "Major S'ville Port Facility Planned for Oil Work," The Cambodia Daily 34 (97): pp. 1-2, August 8, 2006.

[6] "Oil companies line up to drill off shore," Phnom Penh Post 15(14), July 14-27, 2006, and "Cambodia says oil output may start a yr late in 2009," Reuters, July 27, 2006.

[7] Adam Piore, "Cash-strapped Cambodia eyes black gold," Christian Science Monitor, August 30, 2006. <http://www.csmonitor.com/2006/0830/p07s02-woap.htm>

management along the lines of the joint Thai-Malaysian offshore development area.[8] Each side has proposed a division of the disputed area into blocks, and revenue-sharing distributions for each block, but Thailand prefers to have a greater share of the revenue from the western area along its coastline, where the most prospective areas are. [9]Cambodia's onshore oil resources in the Tonle Sap basin were surveyed in the late 1990s by the Japanese National Oil Corporation (JNOC), but this area has yet to be further developed. Three blocks in the Tonle Sap Basin are currently under negotiation for exploration licenses. Development of the oil sector in the Tonle Sap area would be more controversial than offshore production, as it is located in a heavily populated, environmentally sensitive area, home to both the UNESCO Tonle Sap Biosphere Reserve and the World Heritage site of Angkor Wat. Oil has also been discovered in eastern Cambodia, near the border with Vietnam, and two blocks in the area (XXV and XXVI) are being considered for exploration licenses (Annex III).

Although experts have suggested that building a domestic oil refinery in Cambodia would have limited benefits and be unable to compete with established refineries in Thailand and Singapore,[10] the Japanese company Mitsui has announced a partnership with the Cambodian National Petroleum Authority to begin construction of refinery plants.[11] The Cambodian government appears eager to develop downstream capability in the oil sector, although the issue is still being debated.

Successful development of the oil and gas sectors would provide a dramatic increase in government revenue. Rough estimates for long-term production suggest that the annual sales value of oil and gas could surpass $6 billion (current GDP is around $4 billion).[12] The actual contribution of the sector to government revenue is uncertain, as it depends on the cost of production, global oil prices, and levels of production. Contractual obligations are based on a Model Production Sharing Contract (PSC), which was developed in the late 1990s, when oil prices were low and the government had little experience with oil revenue contracts.[13] Under the Model PSC, the terms are generous to the contractor. For example, up to 90% of post-royalty production revenue is available for the contractor's cost recovery, and at lower levels of production (under 50,000 barrels/day), the marginal split is 58-42, which is the lowest governmental share of marginal oil profit in the region except for Malaysia (see Annex IV). Thus, at early stages of production, the oil revenue accrued to the Cambodian government will be relatively low due to the high percentage of revenue going to cost recovery and the unfavorable profit split at lower production levels.[14]

The PSC contract recently signed for Block E with Medco Energi, an Indonesian company, allocated 12.5% of production to the government as a royalty payment and a tax rate of 30%. In addition, Medco Energi contributed $4.5 million in social development project funds.[15]

Many observers, including current prime minister Hun Sen, have warned of the potential negative impacts of substantial oil revenue,[16] citing other global examples of the "resource curse" in which

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[8] Samean, Yun, "No Deal with Visiting Thaksin on Oil Resources," The Cambodia Daily 35 (1): p. 1. August 11, 2006.
[9] Menas Associates 2007, "New proposals on OCA impasse," Vietnam Focus March 2007.
[10] UNDP – Cambodia, "A SWOT Analysis of Cambodia," Discussion Paper, December 2005, and UNDP – Cambodia, "Review of Development Prospects and Options for the Cambodian Oil and Gas Sector," Final Mission Report prepared for UNDP and CNPA, July 11-23, 2005.
[11] "Mitsui to set up energy joint venture in Cambodia," The Financial Express, May 12, 2006. <http://www.financialexpress-bd.com>.
[12] UNDP SWOT Analysis.
[13] UNDP Review.
[14] Ibid.
[15] Antara News 2006, "Medco takes over block E from CNPA in Cambodia," October 6, 2006. <http://www.bkpm.go.id/bkpm/news.php?mode=baca&info_id=4801>

the economic growth of a country is negatively affected by high levels of revenue from non-renewable natural resources such as petroleum. Several multilateral and bilateral donors are concerned about the prospects of a large influx of revenue into a country with significant governance limitations, including pervasive corruption and a lack of public accountability. In Transparency International's 2005 corruption index, Cambodia was ranked 131 out of 158 nations.[17]

There are already a number of initiatives to engage with the government and with CNPA to prepare for the expected influx of revenues, and Hun Sen has pledged that revenues will be carefully managed, with large amounts going to the health and education sectors.[18]

Legal Frameworks and Regulatory Mechanisms

Hard Minerals Sector

Mineral exploration and exploitation are governed under the Law on Management and Exploitation of Mineral Resources, which was ratified in 2001. In order to obtain a license for exploration, the application must first be approved by the Council for Development of Cambodia (CDC), which is chaired by the prime minister and includes the heads of the Ministry of Commerce and the Ministry of Economy and Finance. Once approved by the CDC, the rest of the process seems to be somewhat arbitrary, with regulations and requirements changing frequently. Recently, the number of concessions that can be licensed to a single company has been restricted. Licenses for exploration are acquired from the Ministry of Industry, Mines, and Energy (MIME). Cambodia's license system is relatively attractive for foreign investors, as it allows 100% foreign ownership and has only a 3% royalty on sales.[19]

Under the Law on Environmental Protection and Natural Resources Management, the Ministry of Environment (MoE) must approve an Initial Environmental and Social Impacts Assessment (IESIA) report before MIME can grant a license. However, it seems that IESIAs are not always required, and are often performed after the license approval, rather than as part of the application process. MoE is a relatively weak ministry, and in some instances was apparently not even informed of proposed mining activities until road-building and site preparation began, even in protected wildlife areas under MoE supervision.[20] In addition, the MoE sometimes participates in the IESIA submission process, which is a clear conflict of interest since they are also responsible for evaluation of the IESIA.

While MoE is technically responsible for regulating mining activities, their capacity to do so is limited by relative weakness of the ministry compared to MIME, lack of information availability, and obstruction of enforcement by local, district and provincial officials who tend to support the mining companies.[21] Mining concessions often have powerful backers with government and military connections.

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[16] Kimsong, Kay, "Chevron Ships Drilling Rods to Sihanoukville," The Cambodia Daily 34(73), p. 1, July 5, 2006.
[17] Reuters, "World Bank sets new project to fight Cambodia graft," June 28, 2006. <http://www.alertnet.org/thenews/newsdesk/BKK40395.htm>.
[18] AP 2007, "Cambodia to tap oil revenues in 2010," February 28, 2007. <http://biz.yahoo.com/ap/070228/cambodia_offshore_oil.html?.v=3>
[19] Cambodian Ventures 2005, "Cambodian Ventures Limited discusses the potential for precious mineral exploration in Cambodia," April 17, 2005. <http://www.primezone.com/newsroom/news.html?d=76306>
[20] Fauna and Flora International (FFI) interview, August 4, 2006.
[21] See, for example, WSPA Report on Antimony and Chromium Mining Camp in PSWS, July 9, 2006.

Hydrocarbon Sector
Currently, there is no specific legislation governing oil and gas production. All regulation is under the purview of the Cambodia National Petroleum Authority (CNPA). Under the Petroleum Regulation of 1991, the country, including offshore areas, was distributed into blocks for investor bidding on exploration rights.
There is limited information available about the process of awarding oil exploration rights, or details on size or expenditure of any signature bonus revenues. CNPA was created by a Royal Decree in 1998.

The government plans to develop a Petroleum Act, which would provide a comprehensive regulatory framework for Cambodia's petroleum sector. In the interim period before such legislation is finalized, the government plans to instate a Sub-Decree that will address weaknesses of the current regulatory framework.[22] In addition, the government intends to resolve the conflicting roles and responsibilities of different ministries and agencies regarding the oil and gas sector. This process will almost certainly shift the balance of power and capacity of different agencies to access and manage oil revenue.[23] Improving the organization and capacity of the petroleum administrative framework is one sector where organizations such as the Norwegian Agency for Development Cooperation (NORAD) and AusAID have been involved in providing technical assistance.

Contract proposals must first be submitted to CNPA, then reviewed by the Council of Ministers. The Prime Minister makes the final decision on concession approval.[24]

Principal Actors : Government

Hard Minerals Sector
The mining industry in Cambodia is regulated by MIME, with oversight of environmental and social impacts by the Ministry of Environment. The organization of MIME is detailed in Annex V.

Hydrocarbon Sector
The CNPA was formed in 1998 by royal decree, and is responsible for managing the development of Cambodia's petroleum industry. CNPA was initially established to negotiate with Thailand over the OCA, but is also responsible for supporting private-sector exploration, seeking foreign investment, and regulating all oil and gas production activities.[25] With the discovery of oil, CNPA has become more engaged with policy issues and commercial activities.[26] CNPA chairman Sok An, who also serves as deputy prime minister, reports directly to the prime minister. The CNPA has become relatively secretive and cautious about sharing information, but remains interested in receiving technical assistance from international donors.

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[22] Cambodia-Australia Technical Assistance Facility (CATAF), Assessing Capacity Building Needs for the Cambodian National Petroleum Authority (OCM-CNPA-S1), Terms of Reference and Scope of Work. Available online at <http://www.ausaidcataf.sagric.com>
[23] JICA Interview, August 8, 2006.
[24] World Bank 2006, "Cambodia: Energy Sector Strategy Review." May 2006.
[25] Country Report for Cambodia, speech delivered for Mr. Sok An, Senior Minister and Chairman of the Cambodian National Petroleum Authority (CNPA), 7th ASCOPE 2001 Conference, November 5-7, 2001, Kuala Lumpur.
[26] World Bank 2006, Cambodia: Energy Sector Strategy Review.

The import and export of petroleum is supposed to be jointly controlled by Ministry of Commerce and Ministry of Economics and Finance,[27] with the MEF responsible for levying customs and tax, and the MOC issuing licenses to fuel distributors. There is currently not a clear division of responsibility among the different ministries for various aspects of petroleum sector management.

Principal Actors: The Private Sector

Hard Minerals Sector

Mining industry companies are mostly Cambodian or joint ventures. International partners include Australian, Chinese, US, Japanese and Vietnamese companies (see Annex I).

Hydrocarbon Sector

The major consortiums currently active in petroleum exploration are summarized in Annex II. In addition, there have been reports of cooperation with Vietnamese companies to explore and develop the offshore Vietnam-Cambodia boundary areas, as well as the Tonle Sap Basin.[28] Relations between the CNPA and the companies involved in oil and gas development appear to be quite smooth at this point, with the Cambodian government eager to attract investment and encourage exploration by foreign firms.

Principal Actors: International Financial Institutions (IFI) and Donors

Hard Minerals Sector

There are no IFIs currently working on issues related to large-scale hard mineral extraction.

Hydrocarbon Sector

Cambodia is just beginning to receive IFI funding for extractive industry projects. In mid-2006, there was a joint ADB/WB mission in consultation with CNPA on the impact of oil and gas development. A number of donors are interested in getting involved in this issue, including AusAID, ADB, WB, and JICA, focusing on a range of topics from infrastructure and the tax system to policy development and a petroleum legal framework (see Table 1). At this point, the role that IFIs will ultimately play in Cambodia's oil and gas development is unclear, and is being negotiated among donors and government agencies. The ADB has been holding informal donor meetings to coordinate oil sector activities.

The Public Financial Management Technical Working Group, which is led by the Ministry of Economy and Finance (MEF) and includes several donor organizations, will include oil and gas revenues in their project component on revenue management. This project will focus on engagement with EITI, as well as the provision of technical assistance in the areas of oil fund and taxation policy, negotiations with oil companies, revenue management, and the technical aspects of oil and gas extraction.[29] This donor group has also begun working with the National Assembly (NA) on budget issues, and the response from NA members was promising. A workshop specifically on EITI was held for the National Assembly at the end of August, and included NGO representatives.

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[27] CNPA– Petroleum Exploration and Production Division, Presentation to the First Workshop on Cambodian Case Study, 24 February – 4 March, 2003 Phnom Penh. <http://www.ccop.or.th/ppm/document/CAWS1/CNPA%20basin%20presentation.pdf>

[28] People's Daily, "Cambodia, Vietnam agree to promote bilateral cooperation," August 24, 2006.

[29] World Bank interview, 8/17/06.

Table 1. International financial institution (IFI) current involvement with oil and gas issues in Cambodia.

Institution	Involvement
World Bank	Involved in budget reform and revenue management, integrating oil/gas issues into existing Public Financial Management projects
Asian Development Bank	Provided technical assistance for drafting Petroleum Law (1996) Coordinating IFI roles, approved $700,000 for technical assistance to focus on mid-stream and downstream aspects of oil/gas development, and capacity-building for CNPA
International Monetary Fund	Tax policy
AusAID	Technical assistance package (CATAF) – capacity-building of CNPA, legal framework development, support in contract negotiations
Japan International Cooperation Agency (JICA)	Providing experts to assist Ministry of Economics and Finance with tax and customs regulations; an interest in infrastructure support
Norwegian Agency for Devt Cooperation (NORAD)	Assisting with development of legal framework and CNPA organization and regulatory capacity, support in contract negotiations with oil companies and with Thailand over OCA
Department for International Devt (DFID) – UK	Funds WB's Public Financial Management initiative, which will integrate oil/gas issues. Have been in contact with EITI.

Civil Society Organizations (CSO)

Hard Minerals Sector

A few international and local CSOs are involved in specific small-scale mining projects. For example,

Fauna and Flora International (FFI) has been working in cooperation with the Ministry of Environment for several years to design a management plan for the Phnom Aural and Phnom Samkos Wildlife Sanctuaries. Recently, they participated in the IESIA process for a lead and zinc mine being established in the Phnom Aural Wildlife Sanctuary by providing a critical assessment of the IESIA which was conducted for the project. NGO Forum, a local NGO umbrella organization, also collaborated in this evaluation process.

Local human rights NGOs such as Ad Hoc and Licadho would likely get involved if there is evidence of violation of human rights, which could include concerns about freedom of information. These groups have been involved in advocacy and training for local communities related to land tenure issues.

The Wildlife Conservation Society may do some work on the BHP bauxite development project in Mondolkiri, as they are already involved in that area.

Hydrocarbon Sector

With the prospect of significant oil revenues for the Cambodian government in just a few years, several groups are beginning to consider involvement in issues of oil sector development and revenue management, including large international organizations such as UNDP as well as local, more specialized groups. The World Bank sponsored a workshop for NGOs in May 2006 to discuss examples of how other countries have managed large amounts of non-renewable natural resources and the dangers of the so-called 'resource curse.'

UNDP-Cambodia has funded studies on the development prospects of the oil and gas sector,[30] and has made recommendations to CNPA on potential revenue management schemes and contractual negotiations. UNDP is working closely with the Supreme National Economic Council (SNEC), a government policy advisory body, which specifically requested research papers on oil and gas development. A new research project, with economists from the Overseas Development Institute, will examine the projected social and economic impacts of oil and gas development in Cambodia.

Pact is one of the few NGOs to have included oil and gas sector concerns in its strategic planning.[31] They are interested in coordinating with donor agencies to contract with the Extractive Industries Transparency Initiative (EITI) to develop a strategy for public accountability of oil revenues. The objectives include 1) providing assistance in drafting a legal framework, 2) obtaining civil society representation for revenue decisions, and 3) publicizing the issue. Work on oil and gas issues is just beginning, but Pact has extensive experience from organizing a comprehensive anti-corruption campaign, which included the development of anti-corruption legislation and a widespread public-awareness campaign.

The Cambodian Development Resource Institute (CDRI) is linked to SNEC, whose director is a co-chairman of their board and has encouraged them to do research on the impacts of prospective oil and gas development. The results from this project will be published as a chapter in CDRI's Annual Development Review 2005-06, which is due to be released in the next few months. CDRI is primarily a research organization, which aims to present feasible, technical policy recommendations for specific problems. They have an interest in public accountability, and experience from previous work in resource issues, especially in the forestry sector. CDRI enjoys a positive relationship with the government and is reluctant to tackle sensitive issues.

The Economic Institute of Cambodia (EIC) published a research report with PACT as part of their anti-corruption campaign, and is respected for its expertise in social and economic analysis. However, the findings of the recent EIC report on government corruption have been attacked by both the Finance Minister and the Prime Minister in public speeches, which may limit the ability of EIC to participate effectively in highly public research and advocacy activities.[32]

The Center for Advanced Studies (CAS) is in the process of allocating funding for PhD research to focus on the potential impacts of oil and gas sector development on the Cambodian economy.

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[30] UNDP Swot Analysis, UNDP Review, and UNDP- Cambodia, "Avoiding the Resource Curse: Lessons Learned from International Experiences," Discussion Paper for the Cambodia Economic Forum, January 17, 2006.

[31] Pact's Strategy for Cambodia 2006-2010, "Mainstreaming Anti-Corruption for Equity."

[32] Kimsong, Kay, "PM Chastises EIC Head for Revenue Report," The Cambodia Daily 34(94), p. 12, August 3, 2006, and Kimsong, Kay, "Finance Minister Said to Blast Corruption Report," The Cambodia Daily 34(83), p. 12, July 19, 2006.

Overall, public opinion on oil and gas development is minimal at this point. In general, issues of government corruption and lack of public accountability receive a great deal of media attention, and public sector corruption affects Cambodian citizens on a daily basis. Since oil and gas revenues will likely be subject to the same problems as other sources of revenue, this topic could easily become a matter of widespread public concern.

Civil society organizations have been able to participate in the legislative process in other sectors in recent years, primarily through public consultation and formal comments on draft decrees. A recent sub-decree on community forestry had high levels of civil society engagement, as did a sub-decree on community fisheries.

Table 2. Summary of CSO involvement in hydrocarbon development issues

Organization	**Involvement**
UNDP	Working with SNEC, funded research papers on development prospects from oil and gas development. Funding new research by ODI on potential social and economic impacts of oil revenues
Pact	Interested in working on issues of transparency and accountability related to oil revenue management. Extensive experience with anti-corruption campaigns.
Cambodian Development Resource Institute (CDRI)	Publishing a research paper on oil and gas development in Annual Development Report in late 2006
Economic Institute of Cambodia (EIC)	Previous work with PACT on anti-corruption economic analysis

Impacts

As there is currently no large-scale resource extraction, there are no impacts to detail at this point.

Conclusions

The current exploratory activities in gold, iron, and bauxite mining could potentially develop into large-scale extractive activity in the medium to long-term. Investment (especially from international firms) has increased significantly in the last few years. Sampling data suggests that mineral deposits are significant in quantity, but investor companies must overcome obstacles of limited infrastructure and difficulties in obtaining licenses. Lack of civil society participation in the licensing and regulatory process may lead to conflict between mining companies and local communities. A context of pervasive corruption and limited regulator oversight, as well as a lack of concern for environmental and social impacts, will likely contribute to serious concerns should any large-scale mineral extraction be established. Some conservation NGOs have been involved in attempts to enforce environmental regulations for small-scale mining activities, and their expertise could be utilized in case of further development of the mining sector.

For now, hydrocarbon exploration is primarily off-shore, and therefore has little direct socioeconomic or environmental impact on communities. Most detrimental impacts will be indirect, resulting from state reliance on oil and gas revenues, which may link to larger problems of currency inflation, unbalanced economic growth, and a lack of political accountability.[33] However, if the onshore reserves in the Tonle Sap area or along the Vietnam border are successfully developed,

[33] UNDP Swot Analysis.

there could be more direct negative impacts. While drilling in the immediate Angkor Wat area is highly unlikely, government officials have been optimistic about oil extraction in the Tonle Sap Basin, arguing that the job creation resulting from developing extractive industry in this area would be beneficial for the local economy, which could potentially reduce existing negative environmental impacts by mitigating the reliance on logging.[34]

The main issues for the oil and gas sector are linked to the endemic nature of public sector corruption, and the way in which the Cambodian government will manage the projected revenue from oil and gas development. The government has a record of misappropriation of funds, including loans provided by the World Bank.[35] If oil revenue is as substantial as some projections estimate, the contribution of Overseas Development Aid (ODA) to the government budget will become relatively insignificant, and the leverage of IFIs may be proportionately reduced. Several IFIs and CSOs are attempting to get involved now, in an attempt to protect Cambodia from the 'resource curse' experienced by other resource-rich countries, by developing a legislative framework for petroleum management and mechanisms for ensuring transparency and accountability. This issue has just recently become a topic of concern, and activities and funding are largely still at the planning stage.

[34] "Fuel the future," Invest in Cambodia, <http://investincambodia.com/new_page_9.htm>.
[35] See Phann Ana, "Gov't Official Arrested in World Bank Scandal," The Cambodian Daily 84(94), p. 16. 20 July 2006.

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Antara News 2006, "Medco takes over block E from CNPA in Cambodia," October 6, 2006. http://www.bkpm.go.id/bkpm/news.php?mode=baca&info_id=4801

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"Cambodian Ventures Prepares for Joint Venture on Gold Mining Sites," Cambodian Ventures Press Release, June 16, 2006 <http://www.cambodianventures.com>

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"Mitsui to set up energy joint venture in Cambodia," The Financial Express, May 12, 2006. <http://www.financialexpress-bd.com>

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"World Bank sets new project to fight Cambodia graft," Reuters, June 28. <http://www.alertnet.org/thenews/newsdesk/BKK40395.htm>

WSPA Report on Antimony and Chromium Mining Camp in PSWS (Phnom Ta Kri), July 9, 2006.

Annex I. Hard Mineral Licenses[36]

Resource[37]	*Location (Province – District – Village)*[38]	*Companies*[39]	*Description/Status*
Iron ore	Preah Vihear – Phnom Dek	Wuhan Iron and Steel Group – 50% Baoshan Iron and Steel – 30% Anshan Iron and Steel – 15% Shougang Group – 15%	Licensed in 2007
Iron ore	Preah Vihear - Rovieng (D)	China National Machinery & Equipment Corp Pheapimex Group (KH) Ratanak Stone Cambodia Development Co, Ltd	Two sites in Rovieng district
Iron ore	Stung Treng – Thalaborivath	Try Pheap Co. Ltd.	Licensed 2005
Gold	Mondulkiri – Okvau/P.Khlong, Kratie – Snuol and Mrt. Rumdol	Southern Gold (AU)	MOU 2006
Gold	Ratanakiri	Battle Mountain Gold (US)	Licensed 2006
Gold	Ratanakiri	Summer Gold Investment (US)	Licensed 2006
Gold/MM	Preah Vihear – Rovieng (D) – Phnom Dek	Delcom Cambodia Co. Ltd. (MA)	
Gold/MM	Mondol Kiri - Keo Sima (D) - Antrong	Cambodia Ventures Limited (US). Brighton Minerals (AU)	Acquired from Oksan Cambodia Corp. (licensed 2003); estimated 6.3 ml Mt – disputed ownership
Gold	Kampong Thom - Sandan - Phnom Chi	Vannimex Co. Ltd. (JV)	Licensed 2000
Gold	Kamphong Cham – Memut (D) – Memut	Sun Trading Co (KR)	
Gold/MM	Oudor Meanchey – Banteay Ampil (D) - Andong Bor	Angkor Wat Cement Co. Ltd (JV)	Licensed 2001
Gold/MM	Oudor Meanchey – Banteay Ampil (D) Kampong Thom – Phnom Chi Battambang – Andong Bor	Neoneer (KR)	

[36] This information was compiled from multiple sources, especially MIME, but may not be a comprehensive inventory.
[37] Gold/MM = gold and metallic minerals
[38](D) – district, (C) – commune, (V) – village.
[39] JV = Joint Venture, VT = Vietnam, KH = Cambodia, MA = Malaysia, AU = Australia, US = United States, KR = Korea, CH= China

Gold/MM	Oudor Meanchey – Chongkal (D) – Phnom Kambot	Cambodia Mineral Development Co, Ltd	
Gold/MM	Kratie - Sambo - Koh Khnge	Chhung Kor Chean Pean Co. Ltd.	Licensed 2001
Gold/MM	Preah Vihear – Rovieng (D) – Phnom Ker	Chhong Kor Chhean Pean Co Ltd	
Gold/MM	Mondulkiri – Keo Seima - Me Som	Zhong Xin Industrial Investment (Cambodia) Co. Ltd.	Licensed 2004
Gold/MM	Kratie – Sam Bo (D) – O Tron	Zhong Xin Industrial Investment (Cambodia) Co. Ltd.	Licensed 2004
Gold/MM	Mondulkiri - Keo Seima - Phnom Kus	Anquing (Cambodia) Invest Company Ltd	Licensed 2005
Gold/MM	Mondulkiri - Keo Seima - Phnom Rohai	China Forwin International Investment Phnom Penh Mining Co. Ltd.	Licensed 2005
Gold/MM	Mondulkiri – Keo Seima – Pu Chu Leu	Cambodia Hai Lan Mineral Co, Wang Fa Investment Group	
Gold/MM	Rattanakiri - Ban Lung - Ban Lung	Liberty Mining International (AU), Great Australian Resources	Licensed 2005
Gold/MM	Rattanakiri - Oyadav – Oyadav	Liberty Mining International (AU), Great Australian Resources	Licensed mid-2006
Gold/MM	Stung Treng – Thalaborivath	Mom Good Luck Mining Co. Ltd.	Licensed 2006
Gold/MM	Mondulkiri - Keo Seima - Okhvao, Ochhung	Oxiana Cambodia Limited	Pending approval
Bauxite	Mondulkiri	BHP Billiton, Mitsubishi	Licensed for exploration 2006
Bauxite	Mondulkiri - O Raing	Sonuba Paul Cham Co. Ltd.	Licensed 2004
Bauxite	Mondulkiri - O Raing - Tou Poy	AZ Distribution Co. Ltd.	Licensed 2005
Coal	Oudor Mean Chey – Anglong Veng/Trapaing Prasath – Pharv	Ratanak Stone Cambodia Development Co, Ltd	
Coal	Stung Treng – Se San (D) – Talat	Ta Yi Co, Ltd	
Lead, Zinc	Kampong Speu – Aural (D) – Ta Sal (C)- Samraong (V) – Phnom Prak	Future Environment Ltd (VT)	Licensed 2005 – 70 km2
Antimony, Chromium	Pursat – Veal Veng (D) – Pramaoy (C) – Phnom Ta	Southern Mining Company (CH)	Licensed June 2006 – 100 km2

Ilmenite	Kri Koh Kong – Thmor Bang (D) – O Tatok	Samnang Rea Thbong Thmor Co	

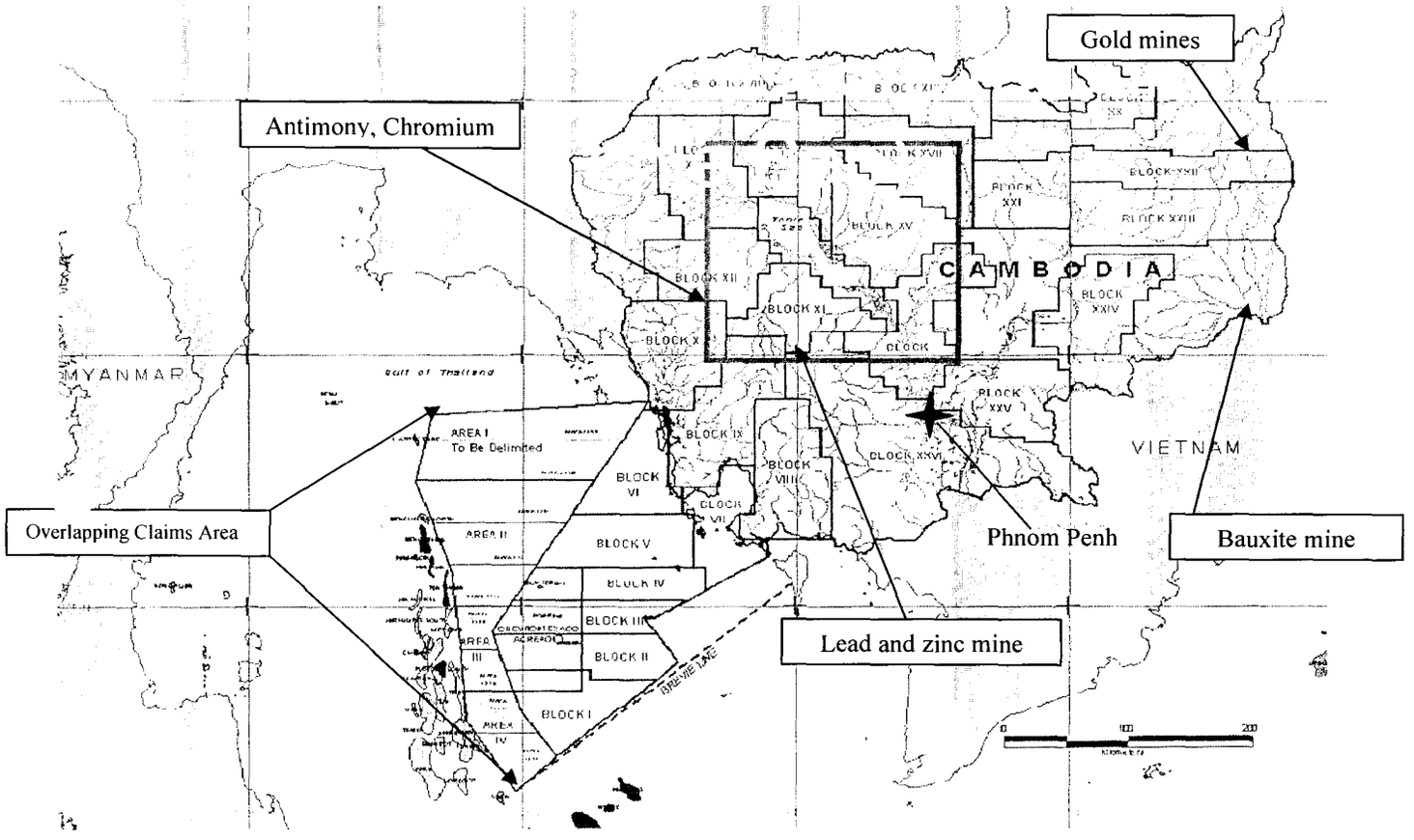
Annex II. Petroleum Exploration[40]

Location	*Companies*	*Area*	*Reserve estimates*	*Description/Comments*
Overlapping Claims Area (OCA)	Amoco, Idemitsu, Conoco, BG, Chevron, Petroleum Resources, Enterprise, Moeco, BHP, Inpex	27,000 km2	Oil: 3 bn barrels Gas: 11 trillion cu ft	Sovereign rights under negotiation w/ Thailand; Cambodia and Thailand have each awarded rights to different companies
Block A	Chevron Overseas Petroleum (Cambodia) Ltd – 55% Mitsui Oil Exploration Co. (Moeco Cambodia) (JP) – 30% LG-Caltex Oil Corp (KR) – 15%	6278 km2	700 ml barrels crude; 3 trillion ft3 gas	130 km off west coast; exploration rights awarded March 2002, drilling rights awarded July 2006
Block B	PTTEP International Ltd (TH) – 33% SPC Cambodia (SG) – 33% Resources Petroleum Ltd – 33%	6551 km2		250 km off coast, east of OCA
Block C	Polytec (Norway)			
Block D	China Petrotech	5507 km2	Oil: 227m barrels Gas: 496 bn cu ft	7 yrs exploration rights, 30 years production rights
Block E	PT Medco Energi (Indonesia)– 90% Kuwait Energy – 30% JHL Petroleum – 10%	5000 km2		Exploration rights – 3 years for first stage
Block F	China National Offshore Oil Company (CNOOC)			Under negotiation
Tonle Sap Basin		30,000 km2		Controversial due to local population, environmental sensitivity, cultural heritage
*Block XII	Suo Ching Industry and Development (KR)			SW corner of Tonle Sap in Persat province; signed MOU

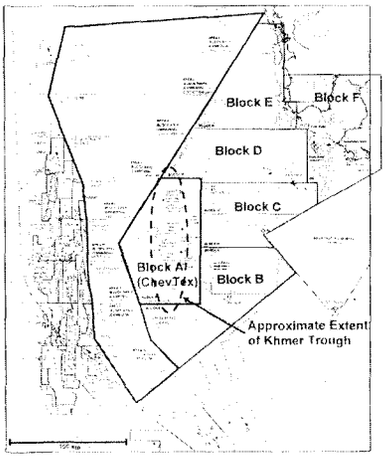
[40] Sources include Country Report (Sok An), USGS Report, Lim Vatha presentation, Te Duong Dara presentation (full citations available in References).

				late 2005
*Block XI	N/A			Under negotiation
*Block XXV, XXVI	N/A			Oil discovered near Vietnam border, licenses under negotiation

Annex III: Map of Oil/Gas and Mineral Exploration[41]



Detail of Offshore Oil Blocks



[41] Map Source: Te Duong Tara (Cambodia National Petroleum Administration), "Petroleum Development A Cambodian Perspective: Offshore Cambodia Areas & Onshore Cambodia Tonle Sap Basin," presentation for the 4th Asian Petroleum Technology Symposium, January 18, 2006, Siem Reap, Cambodia.

Annex IV: Details of Model Production-Sharing Contract

Summary of Regional Revenue Splits (Production Sharing)

	Royalty	Cost Recovery	Profit Oil Split
Cambodia	12.5%	90%	58-42%
Vietnam	0.0%	40%	68-32%
Indonesia	20.0%	85%	85-15%
Philippines	7.5%	70%	60-40%
Myanmar	10.0%	50%	65-35%
Malaysia	10.0%	45%	50-50%
Malay-Thai Joint Area	10.0%	50%	50-50%

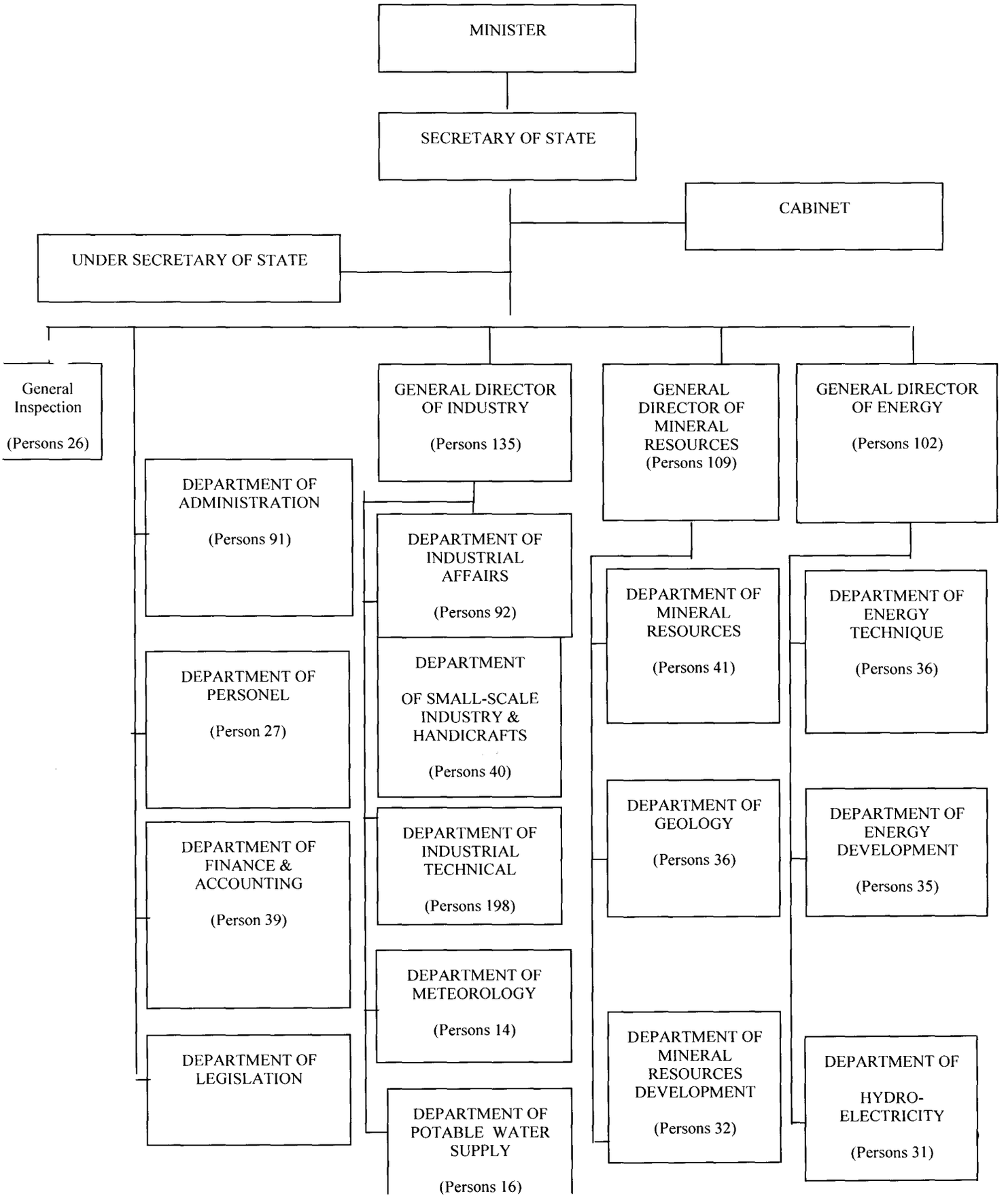
Source: UNDP Review

Estimated Percentage of Revenue per Barrel Allocated to Host Country at Various Prices*#

	$25	$35	$45	$55	$65
Cambodia	18%	33%	42%	47%	51%
Malaysia	38%	38%	42%	48%	51%
Indonesia	20%	41%	52%	60%	65%
Vietnam	41%	41%	41%	43%	47%
Myanmar	36%	36%	40%	45%	49%
Philippines	21%	29%	36%	41%	45%

*assumes fixed cost of $20/bl and profit oil splits at highest marginal splits in favor of the government
#includes revenue from corporate taxes
Source: UNDP Review

Annex V: Organization Chart of the Ministry of Industry, Mines and Energy (MIME)
Source: http://www.recambodia.org/mimechart.htm



Building a Strategic Vision for the Cardamom Landscape: Reconciling Development and Conservation (Draft)

The Cardamom Mountains in Southwest Cambodia will play an important role in the future development of Southeast Asia. The region has abundant natural resources, including timber, minerals, biodiversity, scenic beauty, and the most important natural resource of all: water. The Cardamoms receive up to abundant precipitation because of its mountainous topography and the monsoonal airflows that transport water from the gulf of Thailand into South Asia.

The natural assets of the Cardamom Mountains have been conserved over centuries due to their relative isolation, low human population density, and a combination of historical phenomena that has impeded development. This state of affairs is now changing as the Cambodian government makes strategic investments in transportation and hydropower infrastructure that will integrate Cambodia into the regional economy (1). The future of the region will depend on how the environmental and social impacts of these investments are managed and whether they contribute to the conservation of the biodiversity and ecosystem services of the Cardamom Mountains.

The Cardamom's are home to the some of Cambodia's most spectacular and endangered biodiversity, including elephants, tigers, and the progenitors of domesticated cattle (2). The region's charismatic wildlife species when combined with its majestic forests and unspoiled beaches are key components of a nascent tourist industry. Natural resource management is absolutely essential for the long-term development of the region's industries, including hydropower, forest products, or tourism, all of which are key components in Cambodia's national development outlook. In the case of the Cardamom Mountains, and the surrounding landscapes, conservation and development are not only compatible—they are strategically linked.

HISTORICAL BACKGROUND

The Cardamom Mountains, or *Chuor Phnom Krâvanh* in the Khmer language, have played an important, if secondary, role in the history of the country. Situated to the south and west of the main centers of Cambodian culture, the Cardamom Mountains have acted as a barrier to communications – or as a bulwark to invasion – with neighboring Thailand (3). The ancient Khmer culture and its well-known capital at Angkor Wat depended on an agriculture system based on the alluvial plains surrounding the *Tonle Sap* (Great Lake) and a fisheries based economy based on the same lake which is linked to the Mekong via a river of the same name. The Khmer people, the predominant ethnic group in Cambodia, have maintained contact with the outside world via the *Tonle Sap* and Mekong River; consequently, there was no pressing need to develop transportation links across the highland plateau. In the later decades of colonial rule, highways and rail lines displaced water transport, but even these land-based transportation systems were restricted largely to the flat alluvial plains dominated by the Mekong River and its tributaries. Nonetheless, both the lake and the agricultural plain are physically linked to the Cardamom Mountains by numerous streams that connect the montane forests with the aquatic system that remain the largest source of protein to the Cambodian diet (4).

To the South of the Cardamoms, lie the Cambodian coast and the Gulf of Thailand, an area that was relatively isolated from the center of traditional Khmer economy at least until the colonial epoch when the French occupied the Coast and constructed a rail line from Phnom Penh to a Kampong Son, now known as Sihanoukville. However, the rail line likewise avoided

the highlands by traversing the western edge of the Mekong Delta to the town of Kep, bef winding westward towards Sihanoukville along a narrow strip of coast at the base of the Elephant Mountains, a spur of the Cardamoms to the Southeast. Under the French, the Cambodian coast became an early manifestation of what is now known as the tourist industry, where colonial administrators and entrepreneurs built summer villas in Kep and Kampot, while the Casino and Lodge at Bokor Hill Station attracted visitors from around the world. Kampot is also renowned for its high quality black pepper, which had been cultivated in the region for centuries and became famous during the French colonial period when French chefs incorporated the spice and the name of its origin into their culinary inventions (5). Otherwise, the coastal region has been characterized by isolated fishing villages, large stretches of unspoiled beaches, and mangrove swamps that stretch northward between the Vietnaese border to Koh Kong town the last outpost in Cambodia before entering Thailand.

Situated between the coast and the alluvial plains of the Tonle Sap are the Cadamom Mountains (Fig. 1), which are made up of Central Cardamom Plateau (*Phnom Krâvanh*) and the associated massifs of *Phnom Aural, Phnom Sankos*, ands *Phnom Kran*; the Elephant (*Damrei*) Mountains overlook the Mekong Delta and the *Soi Dao* Mountains are shared with Thailand to the Northwest and is renowned for its blue sapphires and red rubies. Historically, the Cardamom Mountains were sparsely populated by at least three different ethnic groups, known collectively as the *Khmer Deaum*, or ancestral Khmer (6). Historical accounts mention these people mainly by relating the nature and importance of trade in cardamom spice, over which the Cambodian King enjoyed a monopoly until the 19th Century (7). Recent archaeological discoveries have shed some light on the burial practices of these remote people, which used burial jars to honor their dead, in sharp contrast to the Hindu and Buddha traditions of cremating the deceased. The agricultural plain is overwhelming populated by Khmer, but there are at least 22 other ethnic groups, including Chinese and Malay immigrants that have settled in the country over the past several centuries.

. Unfortunately, the isolation of the Cardamoms provided a near perfect haven for the *Khmer Rouge*, both before and after its brutal 6-year grip on power during the late 1970s. The Samlaut District in the northern Cardamoms bordering Thailand was the first region to come under *Khmer Rouge* domination in the early 1970s. Following Vietnam's invasion in 1982, the *Khmer Rouge* retreated to the Cardamom's to wage a civil war that lasted another decade until the Paris peace in 1991, although some soldiers did not surrender until 1996 ands 1999 (8). Durin this time, the ethnic villagers who had lived in the Cardamoms for Millennia were either subject to domination by the Khmer rouge, or evacuated by the national government to villages on the periphery of the Cardamom Mountains in order to deny the *Khmer Rouge* support and sustenance. This traumatic period had a long-term impact on the region and its inhabitants, ranging from the indiscriminant use of land-mines by both sides (9), as well as the loss of their domesticated elephant herds, a significant loss in population, and the obvious disruption of their traditional customs, including the erosion in the use of their traditional languages. As the war came to an end, the surviving *Khmer Deaum* returned to their villages and began the process of recovering abandoned farmlands now covered with second growth forest or *Imperata* grasslands (10). However, these returning refugees were also accompanied, and largely outnumbered by lowland Khmer seeking economic opportunities.

Simultaneously, scientific research identified the region as a conservation priority and official development assistance moved to support the creation a national system of protected areas to conserve the biodiversity of Cambodia (11). The Cardamom Mountains and surrounding areas was endowed with 10 separate units covering xxx hectares, which corresponds to xx% of the total area. The Cambodian government, with the support of development

agencies, invested in infrastructure deemed necessary to integrate the country and stimulate economic growth. This included renovating the national highway network, starting with the trunk highways (R3 and R4) that connect Phnom Penh with the Coast and the major land transportation artery linking the country with Thailand via Kampong Chhang, Pousat, Battambang, and Sisophon (R5). Basic improvements also were made in the secondary road network that penetrated the Cardamoms so as to ensure the complete pacification of this conflict ridden region and its integration into the national economy. Not surprisingly, the improved access provided by the renovated and expanded transportation system led to increased migration and settlement into what had been a vast wilderness area.

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[1] ADB document of some type

[2] F. Momberg and H. Weiler, *Conservation Status of the Cardamom Mountains in Southwestern Cambodia, Preliminary Studies,* Fauna & Flora International, Phnom Penh, 1999

[3] M. Osborne, *Southeast Asia: An Introductory History* and *The Mekong: Turbulent Past, Uncertain Future*, Allen & Unwin, Sydney, 2000.

[4] M. Saburo, M. Keskinen, P. Sokhem, M. Nakamura, Tonle Sap, *Experience and Lessens Learned Brief, (Lake Basin Management Initiative).* World Bank, International Waters Learning Exchange and Resource Network, http://www.iwlearn.net/publications/ll/laketonlesap_2005.pdf/view

[5] Kampot Pepper Farmers' Associations, http://www.kampotpepper.biz/en/context.html

[6] M.A. Martin '*Les Khmer Daeum: Khmer de l'Origine. Société Montagnarde et Exploitation de la Forêt, de l'Écologie à l'Histoire'.* Presses de l'École Francaise d'Extrême Orient, Paris, 1997, from J. Ironsides, *Overview of the distribution of Pear (Por) people in Cambodia,* NGO Forum, Cambodia *(2005)* http://www.ngoforum.org.kh/Land/Docs/Indigenous/Overview.htm

[7] The cardamom of Cambodia is apparently *Amomum kravanh* Pierre ex Gagnep., also known as black cardamomis used as a medcicnal herb in traditional Chinese medicine, while the cardamom used as a culinary spices, *Elettaria cardamomum* L., is cultivated in India, Sri Lanka and Guatemala, see http://en.wikipedia.org/wiki/Cardamom

[8] Cambodia, CIA Fact Sheet, https://www.cia.gov/library/publications/the-world-factbook/geos/cb.html#Intro

[9] Pailin was the last bastion of the Khmer Rouge and is the most heavily mined area in the world. Travelers are cautioned to stay on marked roads. There is a de-mining operation in the city, which brings in some of the few foreigners that the locals encounter. (Land Mine Monitor Report – Cambodia http://www.icbl.org/lm/2006/cambodia.html

[10] The term second growth forest refers to pioneer forest that has colonized abandoned farm land; it is usually composed of fast growing widely distributed (weedy) species. *Imperata* is a genus of grasses characterized by coarse foliage that reproduces by underground stems (rhizomes); is usually unpalatable to livestock; extremely resistant to fire; and very difficult to eradicate.

[11] S. Milne, J. Brunner Conservation and Care in Cambodia's Cardamom Mountains, Conservation International, Woodrow Wilson Centre for International Scholars, May 09 2005, http://www.wilsoncenter.org

FUTURE SCENARIOS

Cambodia is changing. The hard work of the Cambodian people with the assistance the international community is paying dividends in the form of sustained economic growth. Although there are many challenges to consolidating a stable and prosperous future, it is now possible to envision that future. Regional integration, direct foreign investment, economic growth, improvements in basic infrastructure, more and better jobs, and the development of a institutional framework are all part of a positive national panorama that is reflected in the bustling streets of Phnom Penh. Nonetheless, rapid economic growth comes with risks, including severe environmental degradation that can lead to serious long-term impacts and put at risk the future well being of the Cambodian people. The exploitation of both renewable and non renewable natural resources are necessary steps on path to future economic growth, but how that exploitation is managed will determine whether these natural assets are capitalize .o invest in a sustainable future or consumed as part of a scramble for short-term profits.

The Cardamom Mountains and the ecologically linked adjacent landscapes will play an important role in the future development of Cambodia. Exactly how this landscape is developed will depend on the Cambodian people and how they choose to live their lives, organize their country, and participate in international markets. It is impossible to predict this future, but it is possible, based on historical events and scientific research, to envision various scenarios that would likely follow different policy implementations. This section provides three scenarios that attempt to illustrate how the Greater Cardamom Mountain Landscape might look like after a century of human-induced change. Two are decidedly optimistic in outlook, but diametrically opposed in their philosophical underpinnings, whereas the third scenario is a more realistic view of what is most likely to occur without a radical change in current public policies, unregulated markets, and human behavior.

The Utilitarian Scenario

In this scenario, the natural resources are used to create a diversified economy based on maximizing the return on investments over decades and the implementation of a long-term investment strategy designed to extract the greatest value from the region's natural assets by converting them into traditional commodities in demand throughout the region. This vision is sustainable, but requires a technologically sophisticated production model that is efficiently managed by a highly educated populace. Urbanization and industrialization are important and Cambodia takes advantage of its strategic location and cultural traditions to create a world-class tourist industry.

The keystone investment in the Cardamom Mountains is the decision to fully implement 22 hydroelectric power facilities on eight watersheds that provider a total of 1700 MW of generating capacity, meeting almost 50% of the national electricity generation needs in 2050 (12). This investment requires the construction of a paved road network built during the construction phase and used subsequently to maintain the turbines. This network is also used to implement an intensive forest management model that monetizes the hardwood timber assets on state lands over a period of approximately 20 years. Following clear cutting, concessionaires are required to plant immediately a fast growing tropical timber species in blocks with harvest maturities designed to precisely match the processing facilities under construction or planned at the expanded port facilities located in the *Preak Trapeung Stung* estuary near Koh Kong. Fast growing eucalyptus species are the preferred option and as they can be harvested as pulp for paper mills or as feedstock for a biofuel plant that produces ethanol for both the domestic and international market (13).

Industrial minerals are exploited via both open-pit and underground mines and includ iron ore, tungste., ch_____um, nickel, and copper; the road network is expanded and those minerals are exported to overseas markets. However, once hydropower facilities on the main stem of the Mekong River are completed, the electrical generation of the Cardamom watersheds is used to supply processing facilities at Koh Kong, thus adding value to Cambodian production and increasing revenues for the state and adding skilled jobs to the national economy. The hydrocarbon reserves discovered offshore in the first decade of the 21ST Century are matched by similar discoveries in the *Tonle Sap* depression. Most of the hydrocarbons are exported to create a revenue stream for the national government, but a decentralization law dedicates 25% of royalty revenues from minerals and hydrocarbon to investments in the province of origin with another 25% to be shared by the other 21 provinces. The destination of these resources is left to regional assemblies, but most are invested in health and educational facilities, followed by improvements in the secondary road network.

Improved local roads increases the profitability of farmers and there is a gradual consolidation of farm properties, as the more successful farmers expand operations and the average land holding increases from less than one hectare to approximately 10 hectares on the more fertile alluvial soils. Larger land holdings are located in the foot hills of the Cardamom Mountains, where plantation forestry and sugar caned farms requires the economy of scale necessary to manage fertility and pests, while facilitating investments in processing facilities that require long-term contracts to ensure a steady stream of feedstock to safeguard the large capital investment required for a biofuel plant.

On the Coast, Koh Kong has become the principal port for the export of timber, pulp, and biofuels, as well as the site of a coal fired generating facility that sells energy to Thailand and Vietnam via the regional grid; the coal is imported from Indonesia and Australia. Sihanoukville provides logistical support for the offshore petroleum facilities, and the Cambodia Petroleum Company located a refinery and petrochemical complex on the east coast of the *Kampong Soam* Bay, which is the terminus for a large pipeline that transports crude oil produced by the *Tonle Sap* production field.

The industrial facilities north of Sihanoukville have been kept separate from the burgeoning tourist industry that is squeezed into the narrow coastal plain between Sihanoukville and Kep. Known as the Gold Coast of the Orient, it has developed into a booming tourist industry based on beaches, cruise ships, casinos, and recreational activities, including a Disney Indochina that receives approximately 15 million tourists annually, the majority of which come from China, Korea, Thailand, Malaysia, Indonesia and Singapore.

Concern for the environment increases as the country becomes more prosperous, but the decision to monetize the timber assets of the Cardamom Mountains and to maximize the cultivation of tree plantations has transformed the landscape. Although the country has kept its commitment to maintain forest cover at ~ 60%, the definition of forest follows the Scandinavian model to include monoculture tree plantations within that definition. The two large wildlife reserves, *Phnom Sankhos* and *Phnom Aural*, have been reduced in size after a decision was made to recognize the existing settlements on landscapes with flat topography suitable for food crop production. A similar review of land-use conflict and de facto occupancy on the coast led to similar reductions in the national parks of *Phnom Bokor* (20%), *Kiriim* (30%) and *Botum Sakor* (50%). The Central Cardamom Protected Forests was maintained in its natural state, but the southern reserve was rezoned as a production forest, which along with of other state lands, were converted to tree plantations that are harvested on 7 to 15 year cycles. Fortunately, increased prosperity and urbanization has lessened the demand for land, which when combined with improved governance, has lead to the consolidation of the national protected area system

and the elimination of illegal logging and hunting. Nonetheless, the greatly circumscribed geographic area and the now transformed landscapes that separate the individual units has created a protected area system with little resiliency and many species will not adapt to the increasing pressure from climate change.

The institutionalization of a relatively efficient legal system, administrative decentralization, and improved transparency were all key components in the evolution of the stable political environment that was needed to attract investment. Prosperity and improved human welfare slowed demographic growth and the nation population has leveled off at approximately 20 million inhabitants. Poverty has been reduced to nominal levels, surpassing all adjacent countries with much higher base populations and more rigid political systems. Cambodia has been transformed into Southeast Asia's youngest and most successful tiger.

The Utopian Scenario

In this scenario, the natural resources likewise are used to create a diversified economy, but rather than focusing on monetizing the timber assets of the Cardamom Mountains and investing those revenues in plantation forestry, the emphasis is placed on conserving these natural assets to ensure they produce goods and services over the long-term. This approach likewise produces a modern economy linked to global markets, but one in which the business models are focused on adding value to commodities and exporting finished goods. Key to this scenario is an international commitment to reduce green house gas emissions from deforestation, subsequent development of a robust market in forest-based carbon credits, and the decision by the Cambodian state to leverage future development with this market. Tourism continues to play an important role in the national economy, but a more diversified model evolves to take advantage of the natural beauty that characterizes the Greater Cardamom Mountain Landscape

As in the previous scenario, hydroelectric power is the centerpiece of the investment strategy; however, the original design of 22 dams on eight watersheds is modified to include 24 dams on seven watersheds. The modification attains the same total energy generation, but ensures that one river, the *Strung Chhey Areng,* is conserved as a wild, unobstructed river from its headwaters in the Central Cardamoms to its mouth in the *Preak Trapeung Stung* Estuary south of Koh Kong. The Cambodian state chooses to manage these strategic watersheds by conserving the native forest on the hilly terrain throughout the seven watersheds, including those in the production forests. The decision to conserve native forest, rather than replace them with tree plantations was key component of the decision to implement a national forest conservation program and reduce emissions from deforestation and forest degradation (REDD). This decision lead eventually to the certification of approximately XX million tons of carbon credits, which was used by the state of Cambodia to promote sustainable development in the region.

The national forest conservation plan also slowed land-use change in the dry and seasonal forests on the north slope of the Central Cardamom Plateau, the *Veal Veng* Valley in the *Phnom Sankhos* Wildlife Reserve and the xxxxx Valley in the *Phnom Aural* Wildlife Reserve. Settlement in these areas was brought under control and deforestation rates were stabilized and then eventually reversed, by a combination of law enforcement and incentive agreements where inhabitants cooperated with authorities in exchange for investments in education and health facilities, improved social services, and a technologically sophisticated agricultural extension service. The incentive agreements were financed by carbon credits generated by the REDD and also recognized the rights of inhabitants to exploit forest resources, especially high quality hardwood species that are a major input for local businesses that produce statuary and high

Timber exploitation is restricted to local communities and employs a harvest cycle tha conforms to the ecology of individual species, so as to ensure that these species maintain viable population in forest habitats. To minimize forest degradation, reduced impact logging methods are employed to minimize CO_2 emissions, while silvicultural treatments are used to promote the succession and recruitment of the most valuable species. The exploitation of bamboo, a robust species that can tolerate intensive exploitation, is promoted and the development of small local businesses that produce bamboo-based products such as flooring, furniture, and kitchen implements is fostered by ensuring access to affordable credit and technology. The combined income from carbon credits, hard wood and bamboo products increases over time, as the value of carbon credits increases and the large scale production of tropical timber ceases due to measures to curtail deforestation and unsustainable logging in the Amazon and Congo Basins.

Cambodia's drive toward urbanization continues and efforts are made to avoid the over development of Phnom Penh and Sihanoukville. Recognizing that the flood plain of the Mekong River and *Tonle Sap* are inappropriate for the development of large metropolitan urban centers (e.g., Battambang), the government seeks to promote urban development in areas free of inundation by offering tax incentives to corporations that invest in certain areas earmarked as special economic zones (14). One these areas is located between Pousat and Romeas (Kampong Chhang Province) along the old rail line that has been transformed into a rapid-transit system that services a technological corridor dedicated to firms producing electronic and solar energy components for export markets. As part of the government's industrial policy to scale the technological, ladder from textiles to electronics, subsidies derived from carbon credits are offered to the manufacturers of solar panels link and provide a boost to Cambodia's ability to attract high-tech partners from California's Silicon Valley. Another corridor is located between Pailin and Battambang, where the emphasis is in creating manufactured goods for the Thai market, but which has the added benefit to of assisting a part of the country blighted by war and the exhaustion of its gemstone deposits during the Khmer Rouge period (15).

The selection and development of these urban corridors is part of a deliberate national food security policy to conserve the seasonally inundated rice paddies of the *Tonle Sap* and Mekong floodplains. Moreover, this policy is matched with an agricultural extension plan to improve yields and reduce the drudgery of rice farming. The urbanization and industrialization of the Cambodian economy reduces the need for rural labor and mechanization improves both productivity and efficiency. Land tenure consolidation is a natural process, but farms remain small and profitability is increased by the formation of farmer cooperatives and the development of irrigation agriculture to allow double cropping throughout the country. The irrigation model is based not on surface water, but on the abundant ground water resources of the *Tonle Sap* and Mekong flood plains (16). Efficient micro-irrigation systems developed by Israel as a response to sever water shortages are used to manage energy costs and the new two cropping system, includes paddy during the rainy season, but dry season crops are a mixture of green manure to improve soil management and high value cash crops for local and export markets, such as Vietnam, Thailand ands Southern China, which are now completely integrated via an interstate highway system.

The hydrocarbon and mineral sectors are developed in strict accordance with international guidelines for managing environmental and social impacts, but the decision to create a domestic refining complex is curtailed to meet domestic demand and no investments are made in petrochemical complex, recognizing the limited life span of the fossil fuel industrial sector. Consequently, coastal development is spared the worst aspects of industrialization allowing a more orderly and, eventually more lucrative expansion of the tourist industry, including beach hotels and cruise ships, as well as casinos and entertainment. However, the

decision to forgo the industrialization of the forest products sector leads to a high-er ecotourism industry in Koh Kong Province, as well as in Sihanoukville. This includes the use c the road network built to service the hydropower facilities to create a network of forest lodge built in scenic locations in the central Cardamoms, particularly at higher elevations wher temperatures tend to be cooler and insects less abundant.

The development of forest-based carbon credits and the decision to use these revenues to improve the livelihoods of the region inhabitants was a key stage in the consolidation of the national protected area system in Cambodia. The perception, based on reality, that forest conservation brought tangible benefits to the regions residents changed the dynamic of land-use and land-speculation in the region. Likewise, the states decision to conserve the forests of the Cardamom Mountains lead to the consolidation of a Cardamom Mountain Conser ion Corridor that provided sufficient connectivity to ensure that most, if not all, species were able to maintain sufficiently large populations to avoid extinction and improve the probability of adapting to climate change.

The development of a efficient and transparent land registry was the key component in the evolution of the institutional framework that allowed for the incentives from carbon credits to effectively impact forest conversion in the Greater Cardamom landscape. As in the previous scenario prosperity and improved human welfare slowed demographic growth and the nation population has leveled off at approximately 20 million inhabitants. Poverty has been reduced to nominal levels, surpassing all adjacent countries with much higher base populations and more rigid political systems. Cambodia has been transformed into Southeast Asia's greenest and most innovative tiger.

Business as Usual Scenario

In this scenario, the improved governance that makes the two previous scenarios plausible does not materialize and is characterized a chaotic development trajectory where individuals focus on short-term profits. The Cambodian economy grows at a rate of economic growth that lags demographic growth. The absence of forest management is accompanied by the failure to provide technological assistance to farmers. Industrial investment remains focused on low-tech industries with razor thin profit margins operated by foreign companies. Raw commodities remain important, but exports decline as they are exploited or, in the case of food crops, used to satisfy domestic demand. Access to international carbon markets is limited to the technological sector, because the Cambodian state is unable or unwilling to restrict access to forest lands. Tourism continues to play an important role in the national economy, but it remains linked to a single attraction, while the opportunities to develop a world class tourist industry slip away as the natural assets of the coast and the Cardamom Mountains are degraded.

As in the previous scenarios, the hydropower of the Cardamom watersheds are developed, but only the six largest of the hydropower facilities are built because the mega hydro power facilities on the main stem of the Mekong River satisfy the national energy supply. In addition, coal fired power plants on the coast that import fuel from Indonesia and sell most of their energy to Thailand further lesson the need for the small scale hydro power in the Cardamom Mountains. Nonetheless, the road network used to construct the six large dams is completed and subsequently used by settlers and land speculators to occupy land throughout the region. Most settlers practice the most rudimentary form of slash and burn agriculture due to the high rainfall regime and fragile soils and deforested land is quickly abandoned as a secondary forest fallow that cleared again on an approximately 10 year cycle. The low productivity and the progressive degradation of the soils over time, obliges families to colonize adjacent areas over time.

On the less humid landscapes on the north slope of the Central Cardamom plateau and the *Veal Veng* Valley in *Phnom Sankos* Wildlife Sanctuary, a different type of land-use dynamic develops. Urban investors displace the original settlers to consolidate larger properties near major roads, while displaced settlers move further into the forest. The lack of technical assistance forces small farmers to practice subsistence agriculture and, eventually, many choose to sell their properties to survive. Those families that elect to not sell their land-holding tend to subdivide it among younger generations, limiting their ability to produce a surplus and participate in the national economy. Most are forced to work off the farm for low wages, a consequence of their limited educations and the lack of job opportunities in rural areas; many migrate to urban areas.

The failure to establish a modern land registry system contributes to land speculation as unscrupulous individual's fraudulently appropriate land from unsophisticated small land-holders. Land related violence increases because the legal system is characterized by inefficiency and political patronage. The proliferation of agricultural concessions on state lands, combined with land consolidation in settlement areas leads to a two tier agricultural system, where small farmers practice subsistence agriculture on increasingly smaller family farms, while larger urban investors choose to produce non-food commodities with global markets, particularly rubber and biofuels.

The exploitation of oil and gas provides the Cambodian state with a windfall in revenues, which are used to expand public spending and to subsidize consumption by importing food commodities. This policy is a disincentive for agricultural producers, which leads to increased rural poverty and stimulate encroachment on forest landscapes, while reinforcing concessionaire's decision to grow non-food commodities targeted at global markets. Perversely, even though Cambodia is an energy exporter of fossil fuels and provides extensive energy subsidies to its burgeoning urban populations, the marginalization of the rural poor leads to strong demand for firewood and charcoal. Most of the firewood is produced by settlers as a by product of the land clearing process, providing an additional incentive to deforestation.

Urban growth explodes due to an expanding population and rural – urban migration. The decision to provide subsidized fossil fuels to Cambodian consumers leads to an explosion in importation of motor vehicles and subsequent traffic gridlock in Phnom Penh. Unplanned growth radiates outward along the major transportation arteries, particularly Route 4 connecting Phnom Penh to the port cities of Sihanoukville and Koh Kong, but also extending northward towards Battambang and Siamreap where the conversion of paddy rice land to commercial development, displaces small farmers putting further pressuring on the agricultural frontier. Efforts made to improve rice production or implement micro-irrigation systems have limited success because of the disincentive to farmers caused by the subsidized imports of food.

Development on the coast experiences growth that is approximately double the national average, spurred mainly by investments in hydrocarbon infrastructure and tourism. However, rapid growth surpasses the ability of local institutions to regulate development and unplanned construction creates a chaotic mosaic of industrial plants, residential areas, and tourist facilities. Industrial development is a dominated by the hydrocarbon sector, but most of the better paying jobs are held by foreign nationals, including mid-level technical positions filled by individuals from other oil producing countries in Latin America and Indonesia. Chinese and Indian companies rely almost entirely on contract labor from the home country.

The degradation of the Cardamom Mountains rain forest has limited the development of high-end ecotourism, while the unplanned development of coastal islands has lowered the attractiveness of the coastal tourist model. The poor planning and subsequent degradation of coastal habitat has led astute developers to acquire pristine areas in order to convert them to private beaches catering to wealthy foreigners. However, most of the tourist facilities are

targeted at the mass market dominated by economy-minded Chinese tourists. Finally, t disparity in income and the large reservoir of urban poor contribute to the continuation of tl sex-based tourist model, which damages Cambodia's international reputation and impede investment in high quality tourist enterprises.

Environmental degradation associated with deforestation and coastal development i widespread and irreversible. The loss of the biodiversity in the Cardamom Mountains is lamentable, but the degradation of the watersheds and increased erosion lessens the useful lifetime of the hydropower facilities by as much as 50%. The conversion of mangrove swamps to shrimp farms destroys the near-shore fishing industry, displacing small fishermen and their families, who move to urban centers. The offshore coral reefs suffer degradation from global warming and ocean acidification, but pollution from raw sewage dumped into the oc by coastal developers causes a massive die back that damages a natural asset that was a key tourist attraction.

This scenario is a story of lost opportunities. Forest conservation and the associated carbon markets are foregone, because of the failure to control land speculation. Revenues from hydrocarbon lead to a classic reenactment of the natural resource curse, where revenues are used to subsidize consumption to ensure popular support for successive democratic governments. However, these expenditures impede the development of productive activities that create jobs via long-term sustainable economic growth. Cambodia's population continues grow to more than 50 million and is characterized by entrenched poverty and economic inequality, which leads to social unrest, urban violence, and political instability that further impede investment. The failure to take advantage of the unique opportunities present during the second decade of the 21st Century cause Cambodia to be characterized as Southeast Asia's wounded and endangered tiger.

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GEOGRAPHY AND NATURAL HISTORY

The Greater Cardamom Landscape can be defined by its geology, topograph watersheds and political boundaries. For the purpose of this study, a broad definition is used ensure that the drivers of change that are influencing the natural habitats that characterize th Cardamoms are incorporated into the analysis, as well as to document how these habitat provide essential ecosystem services to the Cambodian economy (Fig. X). This definitior covers nine of Cambodia's 24 provinces, including *Koh Kong, Pursat, Battambang, Pailin, Sihanouk, Kampong Speu, Kampong Chhang, Kampot*, and *Kep*, which all together comprise a third of the national territory.

Geology

The most prominent geological features of the region are the associated with the major mountains in Southwest Cambodia, particularly the sandstone formations of the Central Cardamom Plateau, *Phnom Sankos* and the Elephant Mountains, as well as the granite massif of *Phnom Aural*, the highest mountain in Cambodia. More interesting from a mineralogical (and commercial) perspective are the volcanic and metamorphic rocks situated near the Thai border in Porsat, Battambang, and Pailin provinces, as well as other restricted intrusions or ancient lava flows near the Arang Valley and the metamorphic formations associated with the granite of *Phnom Aural.*(17)

Situated to the North of the Cardamoms, the *Tonle Sap* depression is an inconspicuous but strategically important geological feature. The same tectonic forces that have caused the uplifting of the Jurasic and Cretaceous sedimentary rocks of the Cardamoms have also led to the folding and sinking of the sedimentary rocks situated underneath the Great Lake (18). These sediments are considered to have hydrocarbon potential and seismic surveys are being conducted by the Cambodian Petroleum Company. The current surface of the *Tonle Sap* plain is just a few meters above sea level and at various times in the geological past, it has existed as a shallow ocean bay rather than a fresh water lake. The water levels at lake side are a mere 10 m above sea level during the low water period and only 25 – 30 m above sea level at maximum flood stage. The sediments that cover the *Tonle Sap* have eroded from the surrounding uplands, particularly the Cardamom Mountains, and are composed of sand, s ilt and unconsolidated gravels that were deposited during the Pleistocene and Holocene.

Climate and Monsoon

The principal climatic feature of the region is the Asian Monsoon, which is characterized by the flow of humid air masses that transport water from the Indian Ocean and the South China Sea to the Asian landmass. The dynamics of this process is the result of air that heats up more rapidly over land when compared to the ocean. Since warm air rises, a pressure gradient is established across the subtropics and moist air from the ocean is drawn into the continent. As the air rises, it also cools and looses water-holding capacity, producing rain. This unique combination of moist air flows from the ocean and rising air over hot land surfaces is what leads to the sudden onset of the Asian monsoon.

The monsoonal phenomenon occurs across a broad geographic region from Pakistan to Eastern China and is expressed as a belt of rain that processes northward usually starting in early May in southern coastal regions and arriving in mid July in northern India and China (19). It has many regional variations depending on ocean currents and wind systems and has been stratified by climatologists into several geographic subcategories. The monsoon over Cambodia is located at the transition between two of these distinct monsoon subsystems: the South Asian Monsoon and the East Asian Monsoon. Consequently, weather patterns are complex because the region receives rain-belts from both the South China Sea and the Indian Ocean. The onset of the

monsoon over Cambodia usually begins in early May and is essentially a northward extension o tropical thunderstorms from Sumatra.

There is a close relationship between the El Niño/La Niña phenomenon and the onset of the monsoon. Although this link is best known for the impact of the El Niño related drought in Indonesia and Malaysia, it also influences rains over Indochina. When the sea surface temperature in the western Pacific are warm and cold temperatures predominate in the central-eastern Pacific (La Niña phase), the monsoon tends to start early and last longer in Indochina. The increased convection over Indochina during La Niña phase is associated with convergence of winds (inflows) that originate over both the Indian Ocean and the South China Sea. Since the El Niño/La Niña is a cyclical phenomenon with contrasting phases, the opposite scenario occurs during El Niño years when the onset of the monsoon is delayed and precipitation is reduced compared to the average over many years.(20)

Like precipitation, the temperatures regime in Cambodia is highly seasonal. The hottest temperatures occurs at the end of the dry season (April and May), which coincides with the solar equinox and the sun is directly overhead, but also when there is virtually no water on the landscape to provide evaporative cooling. Maximum temperatures exceed 40°Celsius. Minimum temperatures occur in January during the winter solstice and when skies are clear at night allowing for the radiation of heat during the night..

The topography of the Cardamoms Mountains has a large impact on the regional climate. Since the monsoons come from the southwest, the moist air must rise over the highlands; causing heavy rains on the windward sign and a rain shadow on the leeward side. Similarly, the highlands experience cooler temperatures throughout the year and a greater frequency of cloud cover, both conditions that lead to the formation of unique microclimates found nowhere else in the region.

Hydrology

The Greater Cardamom Landscape has two major watersheds: to the north and east multiple small streams feed into the *Tonle Sap* and Mekong watersheds, while the southern watersheds drain into the Gulf of Thailand, either through the complex of estuaries and mangrove swamps near *Koh Kong* or into the *Kampong Soam* Bay north of Sihanoukville (Fig. x). All of these watersheds are strategically important for national development.

Much emphasis has been placed on the hydrological link of the Mekong River with the *Tonle Sap* Lake via the river of the same name (21). Fully 80% of the total precipitation that falls within the Mekong river basin occurs during the 6-month rainy season leading to large variation in water flows and levels cause the curious, if not unique, hydrological cycle of the *Tonle Sap*. The direction of water flow in the *Tonle Sap* River reverse course twice each year; at the midpoint of the rainy season, as the Mekong nears peak water flows, water flows into the low-lying lake from the Mekong. Conversely, as the water levels drop in the main stem of the Mekong River during the early dry season, water flows change direction again and the stock of water stored in the *Tonle Sap* empty out into the Mekong rivers (22).

Less well appreciated is the volume of water that the *Tonle Sap* watershed contributes to the Mekong watershed. In spite of the large water flows that come up river, the *Tonle Sap* still receives over 50% of its input from the surrounding landscapes (23), of which more than half come from the Cardamom Mountains. Even though half of the *Tonle Sap*'s water comes from the Mekong, most of the sediment entering the lake is derived from local watersheds. Recent studies have shown that the overall sedimentation into the lake are low, and have been for millennia, but sedimentation along the margins has increased in the past few decades, evidently a consequence of land clearing on the surrounding landscapes (24).

One attribute of the *Tonle Sap* that has not been much discussed is the aquifer situated in the alluvial deposits that overlay the sandstone bedrock of the *Tonle Sap* depression. The dimensions of this aquifer are poorly documented, but are believed to be large, shallow and easily exploitable. Since the annual precipitation is high and the aquifer is superficial, they enjoy a high re-charge rate and their sustainable exploitation ensured. (25) Nonetheless, data from well-drilling programs has revealed that the alluvium has a high clay content, which restricts water yield to a few liters per second that complicates its potential for large-scale irrigation agriculture (26).

The water flows on the coastal watersheds are greater in volume due to the higher precipitation (~ 4000 mm), but also have a higher potential energy because of the rapid fall in elevation over a relatively short horizontal distance. The precipitation maps for the region are inaccurate, since they extrapolate the difference between the high precipitation records of the coastal; stations with the low records from Battambang, Pursat and the other stations around the *Tonle Sap*. Logic indicates that precipitation in the Coastal watersheds is higher than published estimates. The Coastal watersheds provide important fresh water and nutrient inputs into a key coastal resource the mangrove swamps.

Terrestrial Ecosystems

The upland landscapes are covered by a series of intergrading vegetation types that is largely correlated with precipitation, with evergreen rainforest intergrading with humid, semi-deciduous and deciduous forest types, which form more open woodland and savanna vegetation on some soil types (Fig. x). The floristic make up of these forests have not been studied in any systematic way and botanical inventory has been neglected, at least since the French effort to produce a *Flora du Indochine*. However, the unique geographical position of the Cardamom promises that they will eventually yield a fair number of endemic plant species. This unique position is related to the high precipitation and its geographic isolation from other rain forest ecosystems.

Based on the vegetation map of Cambodia developed by the World Wildlife Fund, the areas in 1997 included almost 65% of the total area within the landscape demarcated for this study as some sort of native upland habitat, with an additional 10% of the areas identified as native wetland habitat (Fig x). The existing stratification of the forest is based almost entirely solely on physiognomy due to the lack of detailed specimen-based forest inventories. Assuming that major types conform to the patterns documented for other tropical forest, a few generalized assumptions can be made about plant species diversity and endemism. Tree species diversity usually is positively correlated with precipitation and negatively correlated with seasonality, while cloudiness, which is a function of local topography and wind flows, is a good predictor of species diversity for epiphytes, such as orchids, ferns and aroids. Lianas are abundant where there is frequent disturbance and are more diverse where drought stress provides them with a competitive advantage over tree species. Extremely hard wooded species are more common in dry forest, where slower growth rates lead to high wood densities, while secondary and pioneer forests are characterized by fast growing soft wooded species that usually are very widely distributed over large geographic areas. Endemism in plants is most common in isolated mountain ranges, such as the Cardamoms, that have no physical connection to landscapes with similar climatic and geological conditions.

Disturbance is also an important factor that influences the development of the habitat diversity observed in the region. Disturbance can be caused by landslides, wildfire, and animals, as well as logging or slash and burn agriculture. For example, the savannas the pine savannas located in the Central Cardamom and the Elephant Mountains probably have been maintained

over millennia by wildfire caused by lightening strikes the higher peaks (> 1000 m). In the absence of fire, this community of plants characterized by open grassland and widely spaced individuals of *Pinus mekussi*, would have been displaced long ago by the more luxurious evergreen, fire intolerant, rain forest species that also occur at the same elevation throughout the Cardamoms. The scattered populations of *Pinus mekussi* are examples of "relict populations" of a species that was more widely distributed at lower elevations during cooler and drier periods of the Pleistocene. Similar isolated populations are known to exist on high mountains in Sumatra and the Phillipines, and they all are apparently related to *Pinus latteri*, a more widespread pine that is found at lower elevations in Vietnam, Laos and Yunnan province in China. These pine savanna are maintained evidently by periodic fires, as evidenced by the blackened trunks of almost all trees and the dominance of grass species in the extremely open understory (Fig. x)

Another common and ecologically important habitat type are the numerous and abundant bamboo colonies that occupy steep slopes in the Central Cardamoms. Bamboo is an arboreal and woody grass species and shares many of the morphological attributes that make herbaceous grasses one of the most successful life forms on the planet. Bamboos groves cover approximately xxx hectares of the Cardamom and they are particularly abundant along river courses and steep hillsides that suffer periodic natural disturbance, be it from flash floods or land slides. Since all bamboos are rhizomatous perennials, they can rapidly colonize these open spaces and then persist over years because of their extremely high productivity. Most bamboos have a unique reproductive life cycle, growing for years (decades) in the vegetative state, then flowering en masse across the entire species, which some taxonomists consider to be large clonal population. Bamboos, because of their unique structural attributes, usually are hosts to a suite of specialist species that include in invertebrates, birds and rodents.

The wildlife of the terrestrial ecosystems of the Cardamoms is renowned for its diversity, endemism and endangered state. This includes many large charismatic mammals, such as elephants, tigers and leopards .....(more stuff)

Freshwater Systems

Wetland habitats vary according to the depth and duration of flooding. Prolonged deep flooding impedes the establishment and survival of almost all plants, even those commonly recognized as aquatic species. However, seasonal or periodic flooding alternating promotes the establishment of a suite woody and herbaceous species with physiological and morphological adaptations that permit them to tolerate periodic inundation. Key to the life cycle of these species is with an extended period with exposed soil that permits seeds to germinate and become established as seedlings in order for them to survive the next period of prolonged inundation. The variations in the length and periodicity of flooding, as well as the depth of inundation and the severity of the dry season drought is what leads to the mosaic of habitat diversity characteristic of the *Tonle Sap* floodplain.

The aquatic systems of the mountains are less productive when compared to the *Tonle Sap*, because they are characterized, in part, by clear water streams that are naturally fragmented by numerous waterfalls and rapids. However, these traits that might limit their productivity are exactly what have driven the evolutionary process that has led to the high number of endemic species that are found in these watersheds.

More stuff

Coastal Habitats

On the coast, the most important types of natural habitat are associated with a group of tree species, collectively known as mangroves. Mangroves are a classic example of what

ecologists as "keystone species". The term keystone refers to the role in an ecosystem (or habitat) and the importance of a morphological trait that is essential to the functional integrity of that ecosystem. The loss of a keystone species (or in this instance a group of similar species) changes the structure and composition of the ecosystem, as well as key functional attributes such as overall productivity. Mangroves are a group of trees adapted to marine and brackish environments in a tidal zone, which is the strip of coast starting from the lowest low water level up to the highest high water level.

Mangrove species have evolved a series of traits that allow them to overcome three physiological barriers that limit the ability of most vascular plants to grow in tidal ponds: poorly oxygenated and highly saline soils, combined with periodic tidal inundation. Several species have *pneumatophores*, which are specialized roots that grow above the water and absorb air, some plants store the excess salt in old leaves, while others secrete via glands on their leaves. An important reproductive is the ability of mature fruits to germinate while on the tree, thus facilitating is establishment in the tidal mudflats, while the proliferation of prop roots and new stems lead to the expansion of mangrove colonies and Are important in land building. In contrast to beaches, which are generally being eroded over time, mangrove swamps are areas that are either stable or which are accumulating sediments.

Mangroves swamps are very productive ecosystems, since they have access to almost unlimited supply of water, while receiving a constant stream of nutrients from adjacent inland landscapes either directly by the mineralization of coastal soils or as runoff from rivers and streams. The economies of coastal regions are very dependent on mangroves, either directly, because villagers use natural products from these habitats or because the productivity of thew coastal fisheries is directly linked to mangroves swamps. Many commercially important fish, including shellfish and native shrimp species depend on mangroves at least during part of their life cycle

..(more stuff)

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THE DRIVERS OF CHANGE

Regional Integration

Hydroelectric, dams, reservoirs & power lines

Agricultural Expansion
Small Land-Holders,
Plantation Agriculture (Concessions)

Forest Use,
Illegal Logging
Community Forestry

Shrimp & Mangrove Deforestation

Mineral Extraction & Hydrocarbons

Recreation Tourism (coastal area)

Industrialization

Climate Change

THE VALUE OF THE NATURAL RESOURCES (ECOSYSTEM SERVICES)

Watershed management

Carbon capture and storage

Climate Modulation (precipitation)

Biodiversity Conservation

HUMAN DIMENSIONS

Migration

Demographic growth

Minorities

Health

Education

March 1, 2008

SUB-DECREE
ON RULE OF GRANTING RIGHT TO CULTIVATE FOREST LANDS FOR TREE PLANTATION

****

ROYAL GOVERNMENT OF CAMBODIA

Have seen the Constitution of the Royal Government of Cambodia (RGC);

Have seen the Royal Decree នស/រកត/0704/124 dated 15th July 2004 on the establishment of the RGC;

Have seen the Royal Code (Preah Reach Kram) 02/នស /94 dated 20th July 1994 on the promulgation of the law on arrangement and implementation of the Council of Minister;

Have seen the Royal Code នស/រកម/0196/13 dated 24th January 1996 on the promulgation of the law on the establishment of the Ministry of Agriculture Forestry and Fisheries;

Have seen the Royal Code 01 នស dated 28th December 1993 on the promulgation of the law on the Financial System;

Have seen the Royal Code នស/រកម/0801/14 dated 30th August 2001 on the promulgation of the Law on Land Management;

Have seen the Royal Code នស/រកម/0802/016 dated 31st August 2002 on the promulgation of the Law on Forestry;

Have seen the Sub-Decree 17 អនក្រ.បក dated 07th April 2000 on the arrangement and implementation of the Ministry of Agriculture Forestry and Fisheries;

Have seen the Sub-Decree 64 អនក្រ.បក dated 11th September 2003 on the change of name of the Department of Forestry to Forestry Administration;

Have seen the Sub-Decree 53 អនក្រ.បក dated 1st April 2005 on the Rule of Procedure for the Establishment, Classification, and the Registration of the Permanent Forest Estate;

Have seen the Sub-Decree 118 អនក្រ.បក dated 7th October 2005 on the Management of State Land;

Receiving the adoption from the plenary session of the Council of Ministers on 7th March 2008;

Hereby decided as follows

Chapter 1
General Provisions

Article 1 The objective of the Sub-decree is to identify the rule of granting right to cultivate forest lands for tree plantation in the Royal of Cambodia.

Article 2 The purpose of this Sub-decree is to increase productivities and forest services to ensure protection of forest cover and secure timber supply for general use and demand in accordance with the national forest policy statement and forest management plan.

Chapter 2
Responsible Institutions and Authorities

Article 3 The Ministry of Agriculture Forestry and Fisheries are authorized to manage the state forest lands for tree plantation and tasked as follows:

- Issue declaration on identification or rejection or cancellation of forest land for tree plantation based on the proposal made by Forestry Administration;

- Authorize Forestry Administration to sign the agreement with local communities, community forestry, or individual household for the right to use forest lands for tree plantation;
- Cooperate or facilitate effective management and use of state forest lands for tree plantation with ministries, institutions, and other relevant stakeholders;

Article 4 The Forestry Administration is tasked to strengthen law enforcement, technical application, to evaluate all kinds of tree planting and harvesting activities, in order to ensure the use of forest resources and forest product effectively. The Forestry Administration is responsible for:

- Issuance of permission for tree planting on state forest land;
- Conducting the assessment and identification of state forest areas and regions for tree plantation;
- Submission of proposal to the Ministry of Agriculture Forestry and Fisheries to issue declaration on identification or rejection or cancellation of state forest land for tree plantation;
- Signing agreement with local communities, community forestry, or individual household for the right to use state forest lands for tree plantation;
- Review, consideration and approval on forest plantation management plan;
- Checking, monitoring, and assessment on the implementation of the agreement and forest plantation management plan;
- Coordination of activities with ministries, institutions, and relevant stakeholders for purpose of granting the using right for the management of state forest lands for tree plantation;
- Coordination and resolution of conflict that may happen during the implementation of agreement;
- Provision of technical services for tree planting.

Chapter 3
Conditions and Legislative Procedures of Application and Granting Decision of Usage Right on Exploitation of State Forest Lands for Tree Planting

Article 5 State forest land areas for plantation must be identified by the Declaration of the Ministry of Agriculture Forestry and Fisheries within the framework of classified level of permanent forest reserve and are registered at the Forestry Administration according to the law on forestry.

Article 6 Tree planting activities on state forest land could be conducted by the followings:

- Forestry Administration;
- Community Forestry;
- Forestry Administration participated by local communities or private sector;
- People or individual household.

Article 7 Forestry Administration must base on the availability of state forest land to evaluate every request to use state forest land for forest plantation and recommend for the decision of the Ministry of Agriculture Forestry and Fisheries. These evaluation and recommendation will be made based on the following criteria:

- Forest land that are easily affected by natural disaster such as flood, draught, and storm;
- Degraded forest land, degraded or bare mountain, forest area destroyed by fire or any other areas which are not yet developed;
- Forest area that need rehabilitation;
- Forest area reserve for re-forestation;
- Forest area reserve for watershed protection;
- Forest area reserve for water source protection and water regulation;
- Former forest concession area or economy land concession that were cancelled
- State forest plantation areas;
- Other forest lands that compatible with re-forestation.

The process of decision and evaluation on each request must be conducted in a manner of close consultation with local Authorities and communities.

Article 8 The request for usage right of state forest land for tree plantation could be done by the following ways:

- Appeal for partner to develop forest plantation on state forest land in compatible with location, area, and geography, that will be stipulated by the declaration on establishment of state forest land for tree plantation issued by the Ministry of Agriculture Forestry and Fisheries;
- Request from individual or legislative body to the Forestry Administration (Ministry of Agriculture Forestry and Fisheries) with supported and relevant documents as instructed by FA.

Article 9 Granting of usage right for forest plantation on the state forest lands to a joint operation between the Forestry Administration and private sector will be done based upon approval from the Royal Government.

Granting of usage right for forest plantation on the state forest lands to a joint operation between the Forestry Administration and local communities, forestry communities, people or individual household will be done based upon the approval from the Ministry of Agriculture Forestry and Fisheries. The agreement must be made with the Forestry Administration.

Every planting activity on the state forest land requires permission letter issued by the Forestry Administration.

For purpose of management of state property, the Ministry of Agriculture Forestry and Fisheries must inform the Ministry of Economy and Finance on the granting of usage right for forest plantation on the state forest lands before the end of every fiscal year.

Article 10 Local communities who request for usage right to plant tree on state forest land must develop their individual management structure. Each community must be recognized by local Authorities.

Communities, people or individual household who are living within or in the vicinity of the requested areas will be given priority for the right of usage state forest land for tree planting. They must be recognized by their local Authorities.

In order to be able to receive grant of usage right for planting trees on state forest land, representatives of communities, people or individual household must be Cambodian citizen with full capacity and legal status.

Private sector wishing to request usage right to plant tree on state forest land must have their office in the Kingdom of Cambodia with financial and technical capability and have been enlisted and recognized officially by ministries or authorized institutions of the Royal Government of Cambodia.

Article 11 Benefit sharing, between the Government and the users of state forest land for tree planting, which derived from planting operation, has been stipulated in article 12 of this Sub-decree.

Chapter 4
Agreement for Granting of Usage Right on Exploitation of State Forest Lands for Tree Planting

Article 12 Elements and minimum conditions stipulated in the agreement for granting the usage right to exploit state forest land for tree planting apply for both joint operation between Forestry Administration and private sector and between Forestry Administration and local communities must be at least describe the followings:

- Timeframe of usage right and validity of the agreement;
- Identification of location and area of forest land granted supported by map showing UTM;
- Types of tree for planting and silvicultural method that will be applied;
- Harvesting and re-planting plans for the following cycle;
- Rights and responsibilities of Forestry Administration and Ministry of Agriculture Forestry and Fisheries;
- Benefit sharing conditionality;
- Obligation of user of state forest land for tree planting in the development and implementation of management plan;
- Monitoring and reporting activities;
- Other conditions which are necessary to ensure sustainable and effective management process.

Sample agreement for granting of usage right for tree planting on state forest land must be developed under a framework of joint Declaration between the Ministry and Agriculture Forestry and Fisheries and the Ministry of Economy and Finance.

Article 13 The users of state forest land for tree planting may request to extend their agreement by submitting the written letter of applications to the Forestry Administration before the expiry date of the agreement. The Forestry Administration will give comments to the Ministry of Agriculture Forestry and Fisheries for consideration and approval.

Article 14 Suspension, halt, closure before end of its validity, cancellation of agreement, and seizure of usage right to exploit state forest land for tree planting from a joint operation between Forestry Administration and private sector due to violation of terms and conditions of agreement or for purpose of public interest, socio-economic, and for environmental protection, must be decided by the Royal Government.

Suspension, halt, cancellation of agreement, and seizure of usage right to exploit state forest land for tree planting from a joint operation between Forestry Administration and local communities due to violation of terms and conditions of agreement, must be decided by the Ministry of Agriculture Forestry and Fisheries. Before the end of every fiscal year, the Ministry of Agriculture Forestry and Fisheries must inform the Ministry of Economy and Finance on these decisions.

Chapter 5
Rights and Obligations of User of State Forest Land for Tree Planting

Article 15 The user of state forest land for tree planting has right to develop, use, sell and distribute own products in accordance with agreement signed between user and the Forestry Administration or user and the Ministry of Agriculture Forestry and Fisheries.

Article 16 The user of state forest land for tree planting has no right to:

- Sell, change, rent, give, joint operate, distribute, lend, pawn, or transfer of state forest land by all means;
- Search for all kinds of mines within the state forest land;
- Farm rice or agricultural crop or build house other than planting tree.

Article 17 The user of state forest land for tree planting is obligated as followings:

- Develop sustainable forest plantation management plan in accordance with guidance from Forestry Administration;
- Planting tree and manage plantation sustainably in accordance with laws, regulations, and agreement;
- Abide by laws, technical regulations, and guidance from the Forestry Administration and the Ministry of Agriculture Forestry and Fisheries.

Article 18 The user of state forest land for tree planting, who has encountered with violation or actual forest offenses within the area of state forest land, must report immediately to Forestry Administration officials or authorized officials nearest by. In this case, the user of state forest land for tree planting could arrest offenders and send them immediately to authorized Forestry Administration officials to continue legislative procedure.

Chapter 6
Forest Plantation Management Plan

Article 19 Sustainable and effective management of forest plantation requires management plan that developed based on its level, dimension and timeframe. There are two levels of forest plantation management plan:

- Master plan for the overall management of the whole area;
- Annual plan of activities.

The user of state forest land for tree planting must develop these two levels of forest plantation management plans in accordance with technical guidelines, regulations for sustainable management of forest plantation. The user of state forest land for tree planting may hire technical services or request technical support from the Forestry Administration. The user of state forest land for tree planting must submit the forest plantation management plan to the Forestry Administration for approval.

Article 20 Forest plantation management plan must has the same validity as the signed agreement. The forest plantation management plan is subjected to review by the Forestry Administration every five years term or event before this period if necessary. Monitoring, review, and evaluating the implementation of the forest plantation management plan must be conducted with participation of all parties who signed the agreement.

Chapter 7
Final Provisions

Article 21 Any regulation that is contrast to this Sub-decree is nullified.

Article 22 Minister in charge of Council of Ministers, Minister of Agriculture Forestry and Fisheries, Minister of Economy and Finance, Minister of Interior, Minister of Land Management Urbanization and Construction, Ministers, State Secretaries, of all relevant ministries, and Governors of provincial cities, must implement this Sub-decree in accordance with their respective duties from this date of signature onward.

Capital city of Phnom Penh, 25th March 2008

Prime Minister
Singed and Sealed
SAMDACH AKEAK MOHA SENARPADEY DACHO HUN SEN

Receivers:
- Ministry of the Royal Palace
- General Secretariat of the Constitutional Council
- General Secretariat of the Senate
- General Secretariat of the National Assembly
- General Secretary of the Royal Government
- Cabinet of SAMDACH Prime Minister
- Cabinet of H.E. Deputy Prime Minister
- Same as article 22
- Royal affair
- Chronological files