

Annual Report for Period:09/2004 - 09/2005**Submitted on:** 08/11/2005**Principal Investigator:** Kolata, Alan L.**Award ID:** 0433787**Organization:** Nat Opinion Research Ctr**Title:**

Economic Growth, Social Inequality, and Environmental Change in Thailand and Cambodia

Project Participants**Senior Personnel****Name:** Kolata, Alan**Worked for more than 160 Hours:** Yes**Contribution to Project:****Name:** Townsend, Robert**Worked for more than 160 Hours:** Yes**Contribution to Project:****Name:** Binford, Michael**Worked for more than 160 Hours:** Yes**Contribution to Project:****Name:** Waylen, Peter**Worked for more than 160 Hours:** No**Contribution to Project:**

Dr. Waylen is responsible for the analysis of long-term climate data, and supervises one of the graduate students below. He has no salary support from this grant, but does have travel and materials funding, as well as a research assistantship for his graduate student, from the project.

Name: Southworth, Jane**Worked for more than 160 Hours:** Yes**Contribution to Project:**

Dr. Southworth is responsible, with Binford, for the satellite remote sensing aspects of the project. Specifically, she is working with Landsat and non-landsat data for land-cover classification and continuous-field variable analysis.

Post-doc**Graduate Student****Name:** Cassidy, Lin**Worked for more than 160 Hours:** Yes**Contribution to Project:**

Ms. Cassidy is a Ph.D. student, supervised by Binford, whose dissertation will be a cross-boundary analysis of land-use and land-cover change in Otdar Meanchey Province, Cambodia and Sisaket Province, Thailand.

Name: Brown, Andrea**Worked for more than 160 Hours:** Yes**Contribution to Project:**

Ms. Brown is an M.S. student, supervised by Binford, whose thesis will be a study of how land-use changes affected hydrological characteristics of the Siem Reap River in Cambodia.

Name: Selover, Michael**Worked for more than 160 Hours:** Yes**Contribution to Project:**

Mr. Selover is an M.S. student whose thesis will be analysis of the spatio-temporal variation of long-term climate data in both Thailand and Cambodia. He has the research assistantship supervised by Dr. Waylen.

Undergraduate Student

Technician, Programmer

Other Participant

Research Experience for Undergraduates

Organizational Partners

Thai Family Research Center, Bangkok

The Thai Family Research Center is an integral part of the research project's activities. TFRC provides the University of Chicago and collaborating investigators from the University of Florida with local institutional, management and operational support for the execution of the research project. Data collection in Thailand is subcontracted to TFRC. Under the terms of this grant, TFRC is also involved in training Cambodian counterparts in the survey research and data entry and archiving components of the project.

Center for Khmer Studies

The Center for Khmer Studies (CKS) is an international non-governmental, not-for-profit organization dedicated to study, teaching and research on the cultures of the Mekong region. Incorporated under Cambodian and U.S. law, CKS is officially recognized as an American Overseas Research Center. Cambodian headquarters are in Siem Reap, Cambodia with a branch office in Phnom Penh.

Part of the Center's mission as an American Overseas Research Center is to serve as a local facilitator for research and training initiatives undertaken by its institutional members. In 2003, the University of Chicago became a member of CKS's consortium and therefore benefits from this affiliation. CKS has consortial arrangements with multiple universities in the United States (including the University of Chicago, Cornell University and the University of California at Berkeley) and abroad.

We have subcontracted the management of the data collection in Cambodia to the Center for Khmer Studies. Under this sub-contract CKS will provide the University of Chicago (UC) with local institutional, management and operational support for the execution of the research project, and will assist in facilitating contacts between UC scholars and their Cambodian/ international counterparts, including representatives of Cambodian universities.

Other Collaborators or Contacts

We collaborate with several universities in Thailand, including Thammasat, Kaesetsart, Chulalongkorn and the University of the Thai Chamber of Commerce (UTCC). The University of Chicago has established in partnership with UTCC a joint research center headquartered in Bangkok. The principal investigator and each co-principal investigator have given lectures on the research project sponsored by the UTCC-University of Chicago Research Center in Bangkok. A broad audience of scholars and public sector employees in Thailand have attended these lectures, from the universities and Bank of Thailand, Ministry of Finance, TDRI, and Bank for Agriculture.

In Cambodia we have established collaborative relationships with staff at the Ministry of the Environment and the Cambodia Development Research Institute (CDRI) in Phnom Penh, and with scholars at the Center for Advanced Studies in Phnom Penh. Also, the offices of the Food and Agriculture Organization (FAO), Department of Meteorology, the Cambodian National Mekong River Commission, and the Department of Water and Forestry in Siem Reap, and the National Department of Geography, the Ministry of Environment, and the National Forestry Commission in Phnom Penh, Cambodia. We also introduced ourselves to several non-Cambodian government or non-governmental organizations in Cambodia: SEILA, a community-based natural resource and environment management organization, representatives of the German Development Service, and representatives of the Wildlife Conservation Society. Each of these organizations was willing to share data with us, including meteorological and spatial data sets.

Activities and Findings

Research and Education Activities:

The major research activity of the project is a comparative analysis of social inequality, economic growth and environmental change in the rural sectors of Thailand and Cambodia. The principal contribution to the disciplines will be an integrated analysis of detailed, longitudinal ecological, social and economic data sets to develop conceptual and formal models that relate economic growth, social inequality and environmental change, particularly with respect to land cover and land use change.

The start date of the project was September, 2004, and the date of this report is 18 July 2005. The entire research team met in Chicago in October, 2004, to plan the field and laboratory work and to assign specific research tasks to each member of the team. We held a second meeting of the research team in March in Gainesville to discuss project progress and plan summer field work in Cambodia and Thailand. At this meeting we discussed and began the design of the project's World Wide Web presence (web pages and web-based data servers). We also decided to follow the land-cover categories developed by the University of North Carolina's research group, led by Ronald Rindfuss, Barbara Entwistle, and Stephen Walsh and previously funded by NSF and NASA, as much as possible in order to make our study comparable with theirs. Finally we have begun to link the environment and socio-economic data bases on a common GIS archive accessible from both institutions.

We completed two separate field trips to Thailand and Cambodia to establish the logistics for intensive data collection in Cambodia, to conduct ecological field research in Cambodia and Thailand, to supervise continuing collection of socio-economic and ecological data sets in Thailand, and to present research methodologies and results to the scholarly community in Thailand through the venue provided by the joint University of Chicago-University of the Thai Chamber of Commerce Center for Research in Bangkok.

Binford, Cassidy, and Brown participated in a field trip to Cambodia and Thailand in May and June 2005. Kolata also was present in Cambodia for several weeks, in part to plan with CKS, so we coordinated our activities and were able to conduct extensive discussions about the project. We visited all four Cambodia study provinces to examine the study area, to collect training samples and ground control points for the remote sensing analysis, and to determine accessibility of the selected villages (see below). Binford and Cassidy also visited the two Northeast Thailand study provinces to collect training samples, with the help of Thai Family Research Center, which is conducting ongoing socio-economic surveys and environmental measurements (funded in large part by the NICHD sources). Kolata and Binford selected 32 villages for socio-economic surveys by using a stratified random sampling approach similar to the one developed by Binford et al. (2004). This approach divides the landscape into forested and non-forested environments, with the additional lacustrine environment in Cambodia near the great lake Tonle Sap, and then selects villages within each of these environments. Final selection of 16 villages is done on a stratified random basis, taking into account socio-economic gradients and logistics. See more below.

Cassidy collected nearly 250 training samples for land-cover classifications and other remote sensing analyses in all areas of Otdar Mencheay (Cambodia) and Sisaket (Thailand) provinces, which are the sites of her dissertation study. Brown's work focused on the watershed of the Siem Reap River, which flows through the Angkor Wat/Angkor Thom region into the Tonle Sap. She collected 203 training samples, numerous ground control points for image registration, and other field data. The team visited all of the Cambodian agencies and NGO's, in both Siem Reap and Phnom Penh, with conservation, environmental, natural resources interests (mentioned above), and were able to acquire much of the existing spatial data that will be required to conduct our original analyses. We established many useful contacts with the agencies and NGO's, and have several informal agreements for data sharing as the project proceeds.

We also acquired large-scale secondary data sets in Cambodia relevant to our research. These secondary data sets included the Socio-Economic Survey (SES), the 1998 Census Data and Village Gazetteer, remotely sensed images and topographic maps for the relevant study provinces, which include Otday Meanchey, Siem Reap, Battambang and Kompong Thom, and relevant research reports from the Cambodia Development Research Institute (CDRI), the World Bank, and the United Nations Development Program (UNDP).

In Thailand, we continued intensive socio-economic and ecological data collection in 16 villages distributed over four provinces and another annual resurvey: Lop Buri, Chachoengsao, Buriram, and Sisaket. We have been collecting monthly datasets of several hundred socio-economic variables from 45 households in each of these 16 villages for the past 70 months. We will continue with this intensive data collection through the life of the grant period. The monthly data collection is funded in part by the UTCC now, and we hoping to partner with the Ministry of Finance for the annual resurvey. Of course this is highly complementary with the current NSF grant with its limited field survey budget.

We are employing the identical socio-economic survey instrument in Cambodia, although at a reduced scale because of resource constraints. In Cambodia we will collect monthly data from 10 households (rather than 45) in 16 villages over the life of the grant beginning with a restricted

number of modules. Initial data collection will commence in late August and early September after 6 weeks of intensive training of Cambodian personnel. Modeling our activities directly after our Thai survey protocols, we have selected 16 villages for study in four provinces: Otday Meanchey, Battanbang, Siem Reap and Kompong Thom. The provinces themselves were selected because of their ecological and socio-economic diversity: one province (Otday Meanchey) is still heavily forested, although undergoing rapid development for timber extraction and pioneering agriculture, while the other three have more diverse economic activities, including intensive agriculture (rice cultivation principally), exploitation of aquatic resources, international trade activities, particularly near the Thai border and, in the case of Siem Reap province, a major tourist component.

As part of our village selection protocols, we stratified the sample universe into three major environmental zones based on satellite images and existent land use maps: (1) 'lacustrine villages'; (2) 'forested villages', and (3) 'non-forest, non-lacustrine villages.' This differs from the environmental stratification that we employed in our Thai village sample to the extent that the first category ('lacustrine villages') is not applicable to the selected Thai provinces. The category of lacustrine village in Cambodia reflects the unique ecological zones represented by the seasonally inundated flood plain and flooded forests of the Tonle Sap, the largest fresh water lake in Southeast Asia. Economic activity around the circum-lacustrine basin of the Tonle Sap is a major contributor to the Cambodian national economy, both historically as well as in the present. Today, for instance, approximately 6% of Cambodia's G.D.P. is generated by economic activity (fishing, fish farming and the production of fish paste for export principally to Thailand) on and around the Tonle Sap.

In Cambodia, our principal activities during the first 10 months of the grant period entailed identifying, recruiting and training local personnel who will be responsible for primary socio-economic and environmental data collection in the 16 villages distributed across the four selected provinces. In this regard, our subcontractor in Cambodia, the Center for Khmer Studies (CKS), accomplished the following tasks over the past 6 months:

- ò recruited local Cambodian administrative personnel, including a field supervisor, data entry supervisor and four team leaders responsible for coordinating and implementing data collection in the four selected provinces
- ò developed plans for employing eight enumerators; these enumerators will be hired during the month of August
- ò established office space in Siem Reap, Cambodia for data entry procedures and provided access to CKS facilities in Phnom Penh
- ò established the work plan and logistics for training Cambodian staff in survey research protocols and procedures in Thailand; the training of Cambodian staff will take place during the entire month of July and the first two weeks of August, 2005
- ò established a time-line for the survey research activities in Cambodia, including appropriate evaluation techniques
- ò began liaison services between project staff and all appropriate local, regional and national government institutions and authorities.

Findings:

In terms of land-cover/land-use change, we observed during the field trip and by comparing the 2000 and 2005 satellite images that there has been much more forest clearing in Cambodia than has been reported by authorities, although this is not surprising. Preliminary analysis of the time-series of Landsat data indicates that much forest clearing is done on a plot-by-plot basis, probably by small holders and mostly along road systems. In addition, there is a second pattern of clearing in which large blocks of forest are cleared in various places, and very often large roads are built straight into the cut areas, presumably to remove the logged timber. These clearings are more likely to be caused by the activities of larger organizations, and in many cases are not legal. There are some security concerns about ground-data collection in the large, cleared blocks of forest and we do not plan to visit these sites for data collection unless the security issues are resolved.

Land-use and land-cover change in the two Northeast Thailand study provinces has recently (80's through the '00s) been intensification of agricultural systems, establishment of tree plantations (rubber, teak, and eucalyptus), and creation of reservoirs. The irrigation system in Thailand provides one of the major contrasting characteristics of the two countries, as the Northeast Thai landscape is dotted with reservoirs and canals, many of which were built in the past 15 years, but the Cambodian landscape just to the south has only one or two reservoirs and almost no large-scale irrigation development.

We have also observed that the thermal band of the Landsat ETM+ will be very useful for differentiating the level of economic development across the border between Thailand and Cambodia. The more converted the landscape (and more developed the area), the higher the temperature as a result of the increased density of the built environment, as well as the larger amount of land in intensive agriculture rather than forest cover (with forests being much cooler in terms of surface temperatures than agricultural regions). The road networks are especially well-defined by the ETM+ thermal sensor, despite the 60-m spatial resolution.

The work in Thailand included a continuing study of the forces driving growth and inequality. The village level (comprehensive) census data of the Community Development Department are being used with the Socio Economic Survey to help predict income and consumption at the amphoe level for the entire country. We have in past research received a listing of the villages of the stratified random sample of the SES. We plan to find the village level characteristics which best explain village average income and expenditures in the SES and then use the CDD to extrapolate over the rest of the country at the amphoe level. Preliminary findings indicate that there is more inequality in incomes across

villages in amphoes which are relatively less developed, though this pattern has lessened over time as national markets have developed and the wage rate for unskilled labor has increased.

Related structural economic models under development identify key variables driving growth in per capita income and inequality, including education, access to the formal financial system, and occupation. But there is more inequality within groups than the current set of models can easily explain. This is the subject of ongoing investigation.

We are also exploring the use of crop models such as DSSAT within and across villages to see if we can understand better the determinants of risk and productivity.

Training and Development:

Currently, the Thai components of the project, including work supported by predecessor grants, have involved multiple graduate students in the Economics Department at the University of Chicago under the supervision of Co-P.I. Robert Townsend. Graduate students have worked as research assistants, and have served as junior authors of research papers based on the ongoing Thai research. Current projects include the creation of income, balance sheet, and cash flow accounts for households of the monthly micro survey, financial transactions and their changes in the annual survey, labor migration, health, business investment, and program/policy evaluation. Again some of this activity is funded by other NSF economics and NICHD grants but we can make good use here. Research materials derived from the Thai-based research have been analyzed in graduate level seminars in economics, as well as in a theory-focused seminar on human-environment interactions in anthropology.

The Cambodian components of the project are now being implemented with the fielding of the socio-economic survey and ecological research on land cover and land use change. We anticipate that the datasets and interpretations deriving from the Cambodian work compared with that of our extant large-scale Thai datasets will offer a rich context for comparative research, and refining of conceptual and formal models bearing on social inequality, economic growth and environmental change. This comparative dimension of the project will stream out directly into the classroom at both graduate and undergraduate levels.

When the socio-economic survey teams are hired and in place in Cambodia, we will undertake training for the Cambodian citizens in GPS use, meteorological measurements, and soil sampling and soil moisture measurements. The enumerators will be village residents and this may be their first exposure to rigorous scientific measurements. They will also be participants in the design of sampling routines.

The ecology/geography group has three graduate students working on dissertations or theses. Their training will be both the traditional graduate education and research reporting, as well as gaining experience conducting field studies in difficult areas.

In both Thailand and Cambodia the field research trains staff as survey supervisors, data entry designers and supervisors, and enumerator. Some of these staff members are promoted within the structure of the project to positions of increasing responsibility, and others use the training and experience that they have received on the project to pursue higher education opportunities locally or abroad, or move into analogous employment opportunities with government or NGO's.

Finally, The Center for Khmer Studies (CKS) has several programs for visiting scholars and fellows at the undergraduate, graduate, and (junior and senior) post-doctoral levels. Some of the fellowships are awarded to Cambodian nationals, some are awarded to students from other countries including France and the U.S. Kolata is a member of the CKS Board of Directors and chairs one selection committee for the fellowships, and will urge the CKS to select some fellows who will be associated with the environmental and LUCC aspects of the project.

Outreach Activities:

In both Thailand and Cambodia we make a special effort to identify and train local people in rural areas to serve as members of the project's field staff. These staff members come from a variety of ethnic backgrounds, including Thai, Khmer, Lao and minority language speakers in both Thailand and Cambodia. Women are well represented as both supervisory and survey field staff.

In addition, our formal affiliations with the Thai Family Research Center and the joint UC-UTCC Center for Research in Bangkok and the Center for Khmer Studies in Siem Reap and Phnom Penh provide multiple opportunities for project staff, both local and foreign, to present the results of the research project to a diverse constituency that includes host country academics, students, government officers responsible for economic development and environmental conservation, as well as key policy makers in the public sector. For instance, each of the principal investigators has presented seminars at the UC-UTCC research center in Bangkok that attracted a wide audience from both the public and private sectors. The Center for Khmer Studies organizes annual seminar series and conferences, and we anticipate that project affiliates will actively present the preliminary results of the field research to similar constituencies in Cambodia as early as January, 2006.

Journal Publications

Books or Other One-time Publications

Web/Internet Site

URL(s):

http://cier.uchicago.edu/townsend_thai/townsendproj.htm

Description:

This is a comprehensive project website developed for the Thai-based research funded under predecessor and ongoing grants from NIH and NSF to project co-principal investigator, Robert Townsend. We anticipate adding a Cambodia component to this website as the data are generated and analyzed over the course of the project. This website is a research database archive that includes sampling procedures, questionnaires, coding, publications and other materials developed by the project. In addition there are links to massive secondary databases developed by the Thai government, including the comprehensive socio-economic survey of approximately 70,000 villages.

Other Specific Products

Product Type:

Data or databases

Product Description:

The project has generated large-scale data sets on villages in four provinces in Thailand. In particular, we have collected monthly socio-economic data on 45 households in 16 villages (four randomly selected villages in each of the four provinces). These data represent several hundred socio-economic and agro-ecological variables that have been tracked monthly for over 6 years. As data are generated from the Cambodian component of the project, we anticipate adding these to the project database and incorporating them in the project website for broad dissemination.

Sharing Information:

As soon as data are processed and cleaned, they are made available on the project website:

http://cier.uchicago.edu/townsend_thai/townsendproj.htm.

Contributions

Contributions within Discipline:

Given that the research supported by this grant has only recently begun, we cannot yet report results that have had significant impact on the disciplines represented in the project, i.e. anthropology, economics and ecology/geography. However, work conducted under predecessor grants to Co-P.I. Townsend and reported by him, including recent NSF-supported research on Evaluation of Financial Structure in Thailand, provide a clear overview of these impacts on the discipline of economics in particular.

The NSF-supported research reported here entails the close collaboration of researchers representing three distinct disciplines. We converge on the fundamental question of the origins and differential trajectories of social inequality in the context of both variable patterns of economic growth and distinct processes of environmental change in Thailand and Cambodia. We are examining how environmental, social, cultural and historical variations interact with economic factors to explain social inequality and variance in income growth in the rural sector of these two countries. The complexity of this societal issue is matched by the difficulty of integrating quantitative and qualitative as well as social and natural science research questions, methods, analytical approaches and modelling. Nevertheless, we have made substantial progress in collectively defining the specific research questions, designing and implementing field research protocols and addressing central questions regarding the interpretation of the data. This progress has been made principally during project meetings that bring the various disciplinary collaborators together for intensive discussions of methods, results and interpretations two times per year at the University of Chicago and at the University of Florida, as well as in daily interactions while in the field in Thailand and Cambodia.

We anticipate that as the data are acquired over the course of the project, and as we continue intensive interactions across our disciplinary competencies in anthropology, economics and ecology, we will have significant impact on: (1) the manner in which anthropologists conceive of and model social change at various societal scales (i.e. households, villages, provinces, nations; regions); (2) the character and complexity of economic models focused on the issue of growth with inequality; and (3) the nature of ecological modeling and understanding of human impacts on the environment at various spatial and temporal scales. Our intent is to effect a significant integration of these three disciplines by focusing on a specific research question the resolution of which requires the application of distinct methodologies and disciplinary perspectives.

Contributions to Other Disciplines:

Since the field research essential to the work supported by this grant has just begun, we have not yet published significant results that have contributed to other disciplines. However, we have begun to communicate and collaborate with a sociologist (Patrick Heuveline, University of Chicago-NORC) who has had long-term interest in and research on demography in post-Khmer Rouge Cambodia. We intend to visit each other's projects in December, 2005, share datasets and engage in systematic discussions of the demographic issues that relate to our fundamental research questions on social inequality, economic growth and environmental change. We anticipate that this sustained interaction will be mutually productive and potentially contribute to each other's disciplines.

Contributions to Human Resource Development:

The three principal investigators on this project are heavily engaged in graduate education at the University of Chicago and at the University of Florida. Students at these two institutions are directly involved in the research project at various levels of intensity (some work as research assistants, others work directly with or are involved in generating project datasets). Several graduate students from the University of Chicago and the University of Florida have made field trips to Thailand and/or Cambodia to conduct primary research that will lead to masters or Ph.D. level theses and dissertations. In addition, we have trained a significant number of Thai students and faculty in survey research design and implementation and, as the Cambodian component of the project develops, students and faculty affiliated with the project and the Center for Khmer Studies a staff members will benefit directly from the research enterprise.

Contributions to Resources for Research and Education:

As reported in predecessor NSF grants to NORC, Robert Townsend P.I., both physical and human capital at NORC/University of Chicago have been developed with current and past NSF support. The information resources include the Thai database and survey and sampling protocols as disseminated on the project's website that can be applied to other regional contexts beyond Southeast Asia and the lower Mekong River basin. In Cambodia the project has established an office headquarters at the Center for Khmer Studies, an international non-governmental organization that is a member of the Council on American Overseas Research Centers. The mission of CKS is to contribute to the reconstitution and further development of social science and humanities scholarship in Cambodia in the post-Khmer Rouge context. We anticipate that the project's headquarters at CKS in Siem Reap will serve as an important node of physical infrastructure for scientific education in Cambodia that will permit local students and faculty to benefit from direct exposure to international standard research design and infrastructure.

Contributions Beyond Science and Engineering:

As noted in predecessor reports to NSF by co-P.I. Robert Townsend, the research methods, results and interpretations in Thailand are having an influence on the Inter- American Development Bank, the IMF, the World Bank and the Millennium Challenge Corporation. We anticipate that the explicitly comparative dimensions of the current NSF supported research that we report here will have a similar impact on policies designed to address the fundamental global problem of economic growth with increasing social inequality, especially in the context of newly developed (e.g. Thailand) and developing (e.g. Cambodia) countries. The challenge here is to deploy our research results to design policies that will encourage economic growth for broad segments of the population, while reducing poverty and social inequality.

Special Requirements

Special reporting requirements: None

Change in Objectives or Scope: None

Unobligated funds: less than 20 percent of current funds

Animal, Human Subjects, Biohazards: None

Categories for which nothing is reported:

Any Journal

Any Book