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Evaluating Bintuni Bay: Some Practical Lessons in Applied Resource Valuation

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Some Practical Lessons in Applied Resource Valuation

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Introduction

In 1990, the EMDI Project in Indonesia asked me to conduct a study that would help the Ministry of Environment build a case for protecting one of the largest tracts of mangrove in the world. Bintuni Bay was located in the most remote part of this vast country, but was the site of a shrimp export industry and the subject of intense pulpwood logging. Earlier work by conservation groups had identified the 300,000 hectare Bintuni Bay mangrove as biologically diverse, and of key local importance to indigenous people. Traditional economic interests seemed in complete conflict with environmental interests. Continued exploitation of the mangrove for pulpwood logging would undermine the ecological integrity of the mangrove ecosystem. Outright conservation would undermine a major export industry and possibly threaten the livelihoods of local people who depended on the resource base. Some balance between these different interests needed to be struck.

The basic objective of the study was to conduct an environmental economic analysis of the various activities taking place in the Bintuni Bay area. The Ministry of Environment was, at that time, starting to close down non-sustainable logging operations while also promoting the conservation of important natural areas. The analysis would provide insights into optimal conservation and development strategies for the resource. Such an analysis needed to be provided quickly to senior policy makers. The entire project – from inception, to field work, to analysis, to input into the decision-making process via a workshop of senior policy-makers – took less than one-half of one year to complete. Timely delivery of an understandable analytical *product* was therefore an important aspect of the study.

But an equally important objective of the work was the development of local expertise to conduct and participate in such analyses. The acronym 'EMDI' stands for Environmental Management Development in Indonesia, and all programs under the Project explicitly required that development of local expertise be placed as a high priority. This participatory approach often prolonged all programs under EMDI, but – as the Project now enters its final (and more modestly funded) phase – the project legacy is that a decade of supportive effort has contributed to a sustainable environmental management institution in the country. The *process* of local education and empowerment was thus also an underlying thrust of all of the work tasks in the Bintuni Bay study.

Most of the publications relating to the Bintuni Bay study have to date focused on the analytical framework, the analytical results, or the policy prescriptions arising from the work (e.g., Ruitenbeek 1992, 1994). The purpose of this paper, however, is to discuss some of the practical aspects of conducting the research. The 'practical aspects' in this case included such realities as a $50,000 research budget, a 6-month work timeframe, field work in a militarily restricted part of Indonesia, selection of counterparts for a field trip exactly coincident with the holy month of Ramadan, stolen field equipment during a 3-day layover for aircraft repairs, sharing a research vessel with an illegally trapped crocodile, retirement of two field crew due to malaria, as well as countless other research realities that never find their way into the sanitized annals of scientific journals.

This paper is therefore targeted to other researchers with the hope that some of the practical lessons learned from the Bintuni Bay study will be useful to them. First, the paper commences

with a brief review of the Bintuni Bay area and highlights some of the central results that came out of the analysis. Second, it discusses the key methodological issues associated with selecting and implementing a research strategy; these methodological issues generally address problems such as valuation technique, data availability and study objective. Third, it outlines what are – in my view – some myths about the three major logistical challenges in any such research program: local empowerment; money management; and, health and safety. Finally, it provides some specific examples from the preparation phase, the field work phase, and the analysis phase on how the various methodological and research issues were addressed in the study. A concluding section includes a retrospective look at the overall study, highlighting those aspects that I believe would be relevant to other researchers.

Bintuni Bay - A First Glimpse

Bintuni Bay is one of the largest mangrove ecosystems in the world, covering approximately 300,000 hectares of area on land and another 60,000 hectares to the 10 meter water depth. Located on the Bird's Head Peninsula of Irian Jaya, its coastal areas support approximately 3000 households (Map 1). The area is surrounded by rainforest-covered mountains and has no roads leading to it. Access is via a one day sea voyage from Sorong or by intermittent aircraft service to landing strips in the villages of Babo and Bintuni.

A cost benefit analysis was conducted in early 1991 to identify and value the major uses of the ecosystem and to identify an optimal management strategy. At the time, illegal cutting of mangrove was being undertaken by some of the forest concession holders, and the analysis thus focused on commercial mangrove harvesting as a key activity that potentially affected both onshore and offshore resources. The analysis concluded that traditional non-commercial uses of mangroves had an estimated value of US$10 million/year, commercial fisheries were valued at US$35 million/year, and selective commercial mangrove cutting schemes had a maximum value of US$20 million/year. Perhaps the most significant 'surprise' from the analysis was the importance of the traditional resource harvesting activities.

The analysis also investigated a number of forest management options, ranging from clear cutting to a complete cutting ban. These were evaluated in a framework that incorporated linkages among mangrove conversion, offshore fishery productivity, traditional uses, and benefits of erosion control and biodiversity maintenance functions. "Linkage scenarios" were developed that reflected potential ecosystem component interactions in Bintuni Bay. The analysis demonstrated that clear cutting is optimal only if linkages are ignored, and that a cutting ban is optimal if linear and immediate linkages between ecosystem components exist. Under a scenario with linear but delayed linkages of 5 years, selective cutting of 25% of the harvestable mangrove was identified as the optimal strategy; it had a present value US$35 million greater than the clear cutting option, and more extensive cutting beyond the 25% level would yield no additional net benefits. The study therefore concluded that strong economic arguments exist for conservative mangrove clearing. Where strong ecological linkages occur, severe restrictions on clearing activities would be economically optimal. Where ecosystem dynamics are uncertain, programs reducing linkage effects – such as greenbelts, replanting, or selective cutting – would minimize the potential economic losses.

In drawing these conclusions, however, the study relied on information gathered from numerous sources – including both household surveys and 'official' company and government statistics – and used a 'linkage' specification that had no precedent. It is therefore quite fair to ask questions such as: How reliable are the data? What analytical short-cuts were taken? Why were some analytical methods rejected over others? To understand the answers to these questions, and ultimately to understand the limitations of the analysis, it is important to reflect on the particular methodological and logistical challenges inherent in this work.

The Research Challenge - Key Methodological Issues and Approach

The methodological issues generally revolve around the problem of selecting an evaluation technique that is consistent with the available data, yet will meet the study objectives within time and budget constraints. In conducting this study, I would like to draw attention to four specific methodological issues that often come up in such circumstances: (i) research 'approach'; (ii) valuation methodology; (iii) method of data collection; and, (iv) treatment of ecological variables and linkages.

Research Approach: RRA or PRA?

There is a growing theoretical literature about the various uses and abuses of rapid rural appraisal (RRA) and participatory rural appraisal (PRA). Excellent surveys and summaries of these approaches are provided by Chambers (1994a,b,c) and Mascarenhas et al. (1991). Simply stated, RRA typically concentrates on conventional hypothesis-testing through well-structured questionnaires conducted by outsiders, with a view to generating specific products that assist in identifying interventions or projects. By contrast, PRA involves a process by which locally affected people set the research questions and contribute to the methods of information gathering and analysis; a key underlying objective of PRA is local empowerment and awareness-building. Both techniques have merit, and the use of one approach or the other (or some combination) depends largely on the objective of the research.

RRA techniques generally are faster than PRA processes, are capable of generating more detailed and consistent data sets that are comparable across regions, and will generate well-defined products for policy-maker consideration. But RRA techniques are also likely to be less innovative, to overlook or understate important local issues, or to generate feelings that affected people are being disenfranchised of their decision-making authority. Selection of the appropriate technique will therefore depend, largely, on whether the research is 'product-driven' or 'process-driven'.

In the case of the Bintuni Bay study, both the product and the process were important outputs. A central research question – "what is the optimal amount of mangrove cut?" – was posed that had very specific information requirements, and required answering within a limited time period. This called for a strong 'product' orientation. But, as noted earlier, local empowerment and participation has been a central philosophy of all activities undertaken by the EMDI program. Methods and approaches in the Bintuni Bay study therefore attempted to strike a balance between these requirements; mostly, however, the approach can be described as a hybrid that involves modified RRA techniques executed by locally trained researchers. In

practical terms, this translated to turning over as much as possible to local control and authority without jeopardizing the general goal of adequately answering the central research question.

Selection of a Valuation Methodology

The major thrust of the final 'product' was to answer the central research question relating to the optimal level of mangrove cut. But the complete study (Ruitenbeek, 1992) also provided a vast amount of information and analysis of socio-economic trends and conditions. These dealt, for example, with income distribution, access to environmental resources by various income groups, the share of rent retained in the region, the role of women in cash and non-cash economies, and the impacts of local production patterns on children's education. While the following discussion focuses on the valuation methodology, it is important to note that such incidental analyses can often be conducted without significant additional effort.

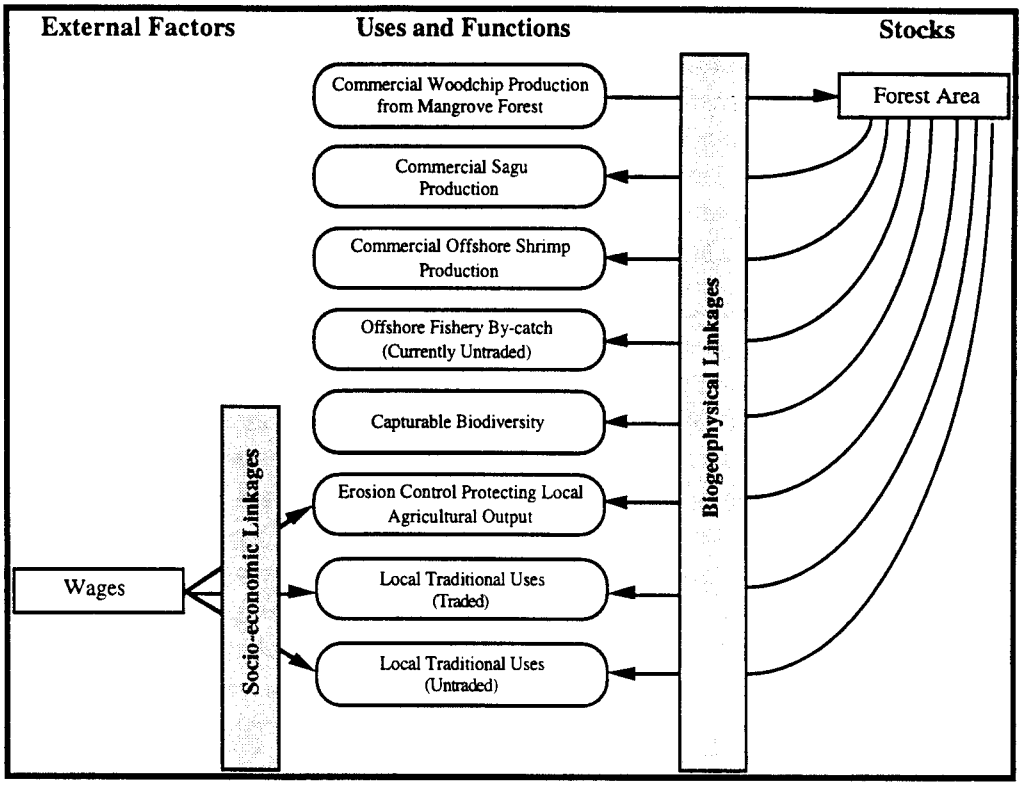
The first question asks "what *resources or uses* are likely to require valuation?" While this seems an almost trivial point, I have seen many exercises that failed to ask this question. Such exercises eventually became 'methodology driven'; by preselecting the method that was used, they often result in failure because the method is inappropriately applied. As a starting point for Bintuni Bay, a checklist approach was used that listed all of the potential ecological functions of the mangrove. The checklist used was loosely based on de Groot (1987); essentially, this checklist provides some 37 potential carrier functions, production functions, regulation functions, and information functions for ecosystems.[1] Based on such a process, Figure 1 shows 8 functions and uses that were eventually targeted for analysis. Because previous studies had largely ignored non-traded uses, an emphasis was placed on these with a view to comparing them to the conventional traded uses such as woodchip production and commercial fishery.

Given these uses and functions, the second issue must address the *technique used for valuation*. In effect, these approaches are either some form of direct valuation (such as production value approaches) or indirect valuation (such as contingent valuation or travel cost methods). The indirect approaches are relevant to problems associated with public goods, non-traded amenities, or private goods for which no surrogate market is readily identified. In the case of the Bintuni Bay functions and uses, most of the uses and functions could be estimated using direct techniques of lost production values. The one exception to this was 'capturable biodiversity value', which was estimated using a rough proxy of international willingness-to-pay for large tracts of undisturbed biodiverse ecosystems. A quick estimate of this capturable biodiversity early in the study showed that it was relatively small compared to other uses and functions; little additional effort was therefore expended on refining this estimate.

With the analysis now focused on about 8 different uses using primarily a production value approach, the next step involves selecting a *practical cost-benefit method* that allows modeling the various interactions among uses. In this regard, it should be recalled that cost-benefit analysis will calculate the net present value (NPV) of some intervention or project. For some studies, all that the cost-benefit analysis needs to consider is whether a specific project is worth

[1] The earlier work was subsequently refined and published in de Groot (1992). A recent review of de Groot (1992) reproduces the 37 item checklist and appears in Ruitenbeek (1995).

Figure 1. Key Uses, Functions and Linkages in Bintuni Bay Mangrove



doing. In such cases, simple valuations of the benefits streams and costs streams are adequate for the entire system. In the case of the Bintuni Bay study, however, a somewhat simplified applied approach was taken to accommodate the need for the extensive scenario modeling in optimization studies. The technique involves separate estimation of 'rents' (benefits less costs) for each of the various functions and uses. This is analytically equivalent to a more detailed estimate of costs and benefits under every potential scenario – and is therefore scientifically defensible – while providing an analytically tractable approach to estimating benefits. In effect, the NPV attributable to each component (or function) is estimated separately and interactions between these components are subsequently modeled. The additional advantage of this approach is that the data gathering techniques for each component (or function) can differ markedly, and additional emphasis can be placed on those functions or uses that are of greater policy interest. The drawback to this technique is that the analyst must be very careful to identify both the costs and benefits associated with any given function; all too often the 'cost' side of the equation is overlooked and rent values are inadvertently overstated.

The next step involves selection of a *shadow-pricing method*. Use of production values requires estimation of the shadow prices of both benefits and costs. Many methods are available to do this and they usually require adjustments for: indirect taxes; regulated prices of domestic goods not traded on the world market (such as electricity or water); transportation differentials; and, wage rates. The most frequently used methods for shadow-pricing involve using national input-output accounts to generate adjustments to market prices; most of these adjustments reflect leakages from indirect taxes or from regulated pricing of goods and services. Although these accounts are available for Indonesia, they were inappropriate for

Bintuni Bay because they reflected 'average' conditions in Indonesia, and the relative remoteness of Irian Jaya presented additional transportation and wage market distortions that needed to be accommodated. Adjustments for indirect taxes in Irian Jaya were not a major concern and, because few of the commodities evaluated relied on government regulated utilities (such as power or water), such adjustments were also not a major factor. The shadow pricing methods used therefore focused on adjusting local benefits by including a transportation cost adjustment, and on adjusting cost streams by shadow pricing local labor based on current unemployment rates. Both of these approaches are still rough approximations but they use readily available data and fall within the accuracy goals set for this study (discussed below).

The final, and perhaps the most crucial, step in methodology selection involves *scenario specification*. In my view, this is one of the most overlooked areas of applied cost benefit analysis and of valuation. If done incorrectly, it can undermine all of the other theoretically and analytically sound valuation work that is done. Basically, for a cost benefit analysis to be analytically sound, it should compare a given project to the most likely outcome in the absence of the project. Specifying a 'project' is typically quite straightforward; specifying an alternative to the project is usually given less attention. A common short-cut approach is to assume that 'nothing' (or some other extreme such as clear-cutting) will happen in the absence of a project, but this assumption is often incorrect. A more careful approach, in which a large amount of information regarding development options is available, would involve specifying the alternative judgmentally. Where very little is known regarding development alternatives, however, a wider range of alternatives must be accepted as potentially viable. The approach used in Bintuni Bay therefore involves an optimization strategy that explicitly required defining a full range of alternatives; this approach requires more analysis but it is necessary where no *a priori* knowledge exists of the most likely alternative. Prior to starting the study, for example, some people believed that an unregulated situation would lead to clearcutting the mangroves on a 30 year-rotation and over-fishing the shrimp resource. The study results showed, however, that this would not be the most likely outcome. The most likely outcome, in the absence of some regulation, would be an even more rapid clear-cut and a modest yet sustainable expansion in the fishery output.

A related component of the 'optimization' scenario analysis involves the *scope of uses and functions* over which the optimization process occurs. In principle, complex models that concurrently select optimal levels of commercial fishery, traditional fishery, logging, and so on, can be specified. This complexity was beyond the policy needs of this particular study. Policy makers were foremost concerned with the optimal use of forest uses, and were interested in how different use of the mangrove forest might effect other components of the ecosystem. The simplified study therefore focused on forestry as the optimized function.

To summarize, the basic methodological approach selected for Bintuni Bay involves an optimization style cost benefit analysis that focuses on the impacts of different mangrove forestry options on the production value of the entire ecosystem. Values for the entire system focused on disaggregating the rents to 8 different components, where rents were estimated based on market prices of costs and benefits adjusted for the opportunity cost of labor and for transportation differentials arising from the remote location of Bintuni Bay.

Method of Data Collection

When working in developing countries, people frequently complain about the lack of data or of its poor quality. Also, data availability problems (and the consequent lack of studies) are the most often cited excuse for lack of action among decision-makers; this is true in developing and developed countries. It seems to be particularly true of ecological problems, where the entire systems are often poorly understood and scientists are reluctant to draw conclusions without thoroughly analyzing the problem. I am personally convinced, however, that – because of system complexity – no amount of data will ever be enough to provide unequivocal answers, and that both decision-makers and researchers must come to grips with the reality of decision-making and analysis under conditions of extreme uncertainty. This viewpoint is reflected in my general approach to data collection for all studies, and explicitly requires me to 'draw a line' for the quality of data that I collect and ultimately use in the analyses.

To start, I would like to outline a few concepts that I find helpful as a backdrop to any discussion of data collection. These are: (i) precision versus accuracy, and, (ii) confidence class estimates.

My dictionary defines 'precision' as 'being sharply or clearly determined' while it defines 'accuracy' as 'being correct'. When conducting any piece of work, I feel that we should be more interested in accuracy than in precision. Unfortunately, many analysts masquerade inaccurate work by providing apparently very precise numbers. For example, I have an official Canadian government oil price forecast done in 1980 that predicts oil prices in 1995 to be US$75.46 per barrel. This figure is very precise, but it turned out to be grossly inaccurate. I have another document written at the same time that states that oil prices will likely be about $20 per barrel through the 1990s. This statement is not very precise, but it turned out to be much more accurate.

The lesson from this is that 'accuracy' is a relative term that requires some subjective judgment on the part of the analyst. The question one rightfully asks then is: "Relative to what?" I think that the accuracy is relative to: (i) the potential uncertainty in the actual system; (ii) the inherent attributes of the chosen modeling framework or methodology; and, (iii) the decision-maker's policy needs. With respect to the first two, one should consider the relative inherent uncertainty within ecosystem response or the modeling methodology; there is no point in getting very accurate data if the system itself or if the modeling framework that describes it can not use the data. In the case of Bintuni Bay, ecosystem responses were regarded as highly uncertain and the modeling framework itself made a number of simplifying assumptions that limited the number of variables under consideration. Finally, the primary use of the analysis would be to educate decision-makers and others about the linkages and to plan appropriate interventions. Such planning and education tasks generally require less information than do detailed project design and implementation tasks. In short, a high degree of data 'precision' was not necessary in the Bintuni Bay study.

To operationalize this 'accuracy' concept, I use a judgmental confidence class estimate to rank my data requirements (Table 1). This is based loosely on cost engineering conventions typically used by the private sector in developing and implementing investment proposals. The scheme explicitly reflects the idea that higher degrees of accuracy generally have different applications, and that higher degrees of accuracy will normally require more time or effort to

Table 1. Confidence Class Categories for Different Applications in Data Collection

Category	Application	Accuracy*	Uses
Class 7	Education	+100% / -50% [at 1 s.d.]	A rough 'order-of-magnitude' estimate, useful as an indicative measure and primarily to be applied for awareness building or to establish preliminary priorities.
Class 6	Setting Priorities	+100% / -50% [at 2 s.d.]	For setting priorities and for short-listing potential project alternatives.
Class 5	Preliminary Evaluation	±50% [at 2 s.d.]	Typically the first level of an engineering cost analysis to determine whether a project might be worth pursuing in more detail.
Class 4	Preliminary Design	±30% [at 2 s.d.]	For budgeting purposes, allocating funds, and final decision-making regarding the desirability of a project.
Class 3	Final Design	±20% [at 2 s.d.]	Based on detailed site evaluations and surveys and provides an adequate basis for identifying specific material flows.
Class 2	Tender	±10% [at 2 s.d.]	For detailed accounting, ordering of materials, or specification of output shipments.
Class 1	Audit	±5% [at 3 s.d.]	Usually an 'after-the-fact' measurement of conditions under controlled circumstances, used for compliance monitoring or similar audit tasks.

* s.d.=standard deviation; 1 s.d. : ~75% confidence; 2 s.d. : ~95% confidence; 3 s.d. : ~99% confidence.

achieve. Many people are surprised to find out that most corporate decision-making is done on the basis of Class 5 estimates for both cost and revenue forecasts. Many public policy applications require a similar level of accuracy, even though researchers often seem unwilling to concede that their findings have such a high degree of uncertainty associated with them. In the case of the Bintuni Bay study, which has a high awareness-building element to it, a Class 6 estimate was judged to be the minimum acceptable information requirement for all of the eight uses and functions; the data collected were, however, of about Class 5 quality on average.

Based on this assessment, a cursory review was conducted of likely data sources. Biophysical data for forestry and fisheries were available through government agencies that monitored these activities. Most of this was based on compliance monitoring, of industry reported statistics, or of actual sales volumes as reported through the customs and excise department of government. These data were generally regarded as being of approximately Class 3, 4 or 5 quality. Such a level of data quality did not therefore require any special data gathering exercises, given that the accuracy was well within that required of the analysis. The exception, however, was for non-marketed and traditional uses of the mangrove. No existing information was available that would provide any comparable figures of either material or monetary flows. It was thus concluded that a detailed survey of the local villages would be necessary to gather such information.

Most of the field work was, therefore, organized around the design and conduct of a household survey that would provide an adequate indication of these flows. The design of the survey (shown in Annex A) reflects a number of principles in data gathering that are worth highlighting. First, the survey provides *flexibility* in response. Second, it provides opportunity

for replication at a later data; household location was carefully noted in a complementary mapping exercise. Third, it provides a number of explicit quality control variables that subsequently permit analysts to assess the reliability of the data.

Treatment of Ecological Variables

As noted above, the most significant uncertainty relates to ecosystem response. In the case of Bintuni Bay, no studies had been done of the actual linkages between mangrove area and the other system functions. In an optimization study, such linkages would be regarded as critical to the overall result. Limited studies had been done elsewhere in Indonesia and in similar tropical systems in Australia. These generally demonstrated that there was some linkage between ecosystem productivity (such as fishery output) and mangrove cover, but the linkages were not well understood. More seriously, quantification of these linkages generally eluded scientists. Finding an acceptable means of dealing with this complete lack of information represented a significant research challenge.

Three options were considered. The first option involved conducting ecological studies at Bintuni Bay that might allow a better ecological description of the material flows in the system. Such a study would have taken a decade to complete and was therefore regarded as unworkable from the perspective of this analysis. The second option was to base the analysis on a 'best guess' of the linkages, and to use that (in terms of a direct link between mangrove area and ecosystem productivity) as a basis for all optimization runs. This would be relatively simple, but no ecologist was prepared to offer a best guess and, in any event, there was no means of checking how accurate the guess might be.

A third option was therefore chosen that involved extensive computer work but no field work: a series of potential 'linkage scenarios' were defined in a new parametric formulation that reflects both the extent of the linkages and the delays in the linkages. The formulation was designed such that the range of scenarios covered spanned all of the likely linkages. A "No Linkage" scenario, for example, reflected no interdependency of uses. A "Very Strong" scenario, reflected a direct correlation between ecosystem productivity and mangrove area, with immediate responses to any impacts. This approach would subsequently permit running optimization analyses under the different linkage scenarios; these would point to the robustness of optimization results and could, more significantly, be used to analyze the consequences of making an incorrect decision on the basis of incorrect ecological assumptions.[2]

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[2] The concluding parts of the study make the following observations: "It must be recognized that there is still considerable uncertainty in the dynamics of specific mangrove ecosystems. The previous sections have demonstrated that *if we know* the nature of these interactions, an economically optimal strategy can be selected. The analysis also demonstrates that *if we do not know* the nature of the interactions, an incorrect guess can have substantial economic penalties. If for example we *assume* that there are weak delayed interactions and select an 80% selective cut on that basis, and if it turns out that the *actual* interactions are immediate and linear, then the economic value of such a decision in the Bintuni Bay case would be about Rp500 billion *less* than what was expected, and Rp160 billion *less* than the optimal strategy." (Ruitenbeek, 1992; p.39)

Summary

The selection of methodologies requires the researcher to address a number of questions about his or her research project:

> In selecting a general approach, how important is the research process relative to the research product?
>
> In selecting an analytical methodology, what specific research hypothesis or question is being addressed and what are the priority items that need to be evaluated to address this question?
>
> In collecting data, what level of accuracy does the final decision-making require, and how much precision can honestly be presented given the inherent behaviour of the system or the inherent limits of the modeling structures being used?

In closing this part of the discussion, it is also worth noting that there are many other interesting analytical methods and techniques that can be brought to bear on this type of problem. I have, for example, used – in other circumstances – Monte Carlo style risk analysis, qualitative dependent variable analysis, general equilibrium modeling approaches, non-linear fuzzy logic approaches, and non-linear dynamic complex system models to describe ecological and economic system linkages. Personally, for purely scientific research work, I prefer many of these non-linear approaches to those used in the Bintuni Bay study. However, none of these approaches are readily transferable to most counterparts or analysts in developing countries and I therefore avoid them in any research that has a strong 'process' or participatory element.

The Logistical Challenge - Myths on Empowerment, Money and Health

Even when study methodologies and data collection methods have been chosen, there are still numerous logistical obstacles that must be overcome in conducting any particular research program. All of these logistical challenges must be met with the same type of rigor that one applies to the scientific issues. But there are tradeoffs inherent in the logistical issues as well, and I would like to draw attention here to some of the critical issues that are often overlooked. In Bintuni Bay, as well as in other projects in which I have been involved, I have found that the most sensitive issues involve 'myths' about empowerment, money and health.

The Myth of Empowerment

> "Any form of local empowerment is 'good'; the less we do as outsiders and the more we permit our counterparts to do, the better."

This is the first myth of participatory research. There are numerous instances in which empowerment can inadvertently backfire, and which the well-informed researcher must try to avoid.

The first is what I call the "Puppet-master Effect". When Europeans first came to Africa, for example, they sometimes decided that the safest thing they could do was support whichever group was in power at that time. On occasion, such as in Burundi, they ended up supporting a

small minority tribe, and inadvertently escalated an ethnic conflict that has lasted centuries. The same effect can happen, albeit at a smaller scale, when working on a research project in developing countries. Probably the most common fault is to strengthen existing local power structures beyond their inherent capacity. This can occur through dealing exclusively through single agents (such as the village head) or through interviewing only the household head in a household survey (who is often male). To avoid this trap, I have found that a good rule of thumb is to try to 'disperse the empowerment' as much as possible, by involving more people rather than fewer people at every step of the process.

The second might be termed the "Over-Delegation Effect". This occurs when so much of the workload is delegated to others that the senior researcher himself or herself appears to be doing none of the work. Resentment among team members can, and does, build up very quickly in such instances; work quality suffers and team morale goes down. To avoid this, there are two rules that I try to follow: (i) never ask anyone to do anything that you would not do yourself; and, (ii) figure out what the least enjoyable task is and do it yourself.

Third, one should beware of "Contrary Team Members". Everybody makes hiring mistakes. Seemingly enthusiastic team members at the outset may turn out to be ineffective or uninterested in the project after a short exposure to it. It takes a certain managerial skill to recognize these individuals and either help them through their difficulty or, if circumstances warrant, release them from their duties so that they do not undermine the project or the process.

Finally, the most insidious and difficult to detect is the "Languishing Effect". This occurs when authority is delegated but nobody in fact exercises it. It may be that people do not want to be 'empowered', or that they do not know what do with the authority when they have it. In either case, nothing happens, the project languishes, morale declines, and the project in the end is typically judged a failure. To avoid this, some type of intervention is often required to try to maintain some form of momentum, but researchers have different thresholds at which they choose to intervene. In the case of the Bintuni Bay study, my threshold was very short as I was under a time constraint, but I have known of researchers who have willingly waited for years for a simple bureaucratic step (such as a research permit) on the rationale that it empowered local people.

The Myth of Money

> "Successful research is expensive; more money will provide better results."

Most researchers are under relatively tight budget constraints, hence this refrain is quite common. It is also common to blame lack of funds for poor quality of data. But the reality is that a properly budgeted research program usually will meet the required data needs. Excessive budgetary allocations can backfire for a number of reasons.

First, extra money removes some of the pressure to define data needs carefully. In my view, the discipline necessary to define the data needs properly is an important part of the research process as it forces the researcher to identify the most efficient means to meet these needs. In the absence of such discipline, too much data can be collected, or the wrong type of data might be collected.

Second, I have often been in field situations one or two years after others have been in the same 'market' area. If the first wave of researchers were rich and free-spending, then this can 'spoil' the market by making all subsequent research programs more expensive, thereby constraining the work of others. A considerate researcher should be careful to avoid this.

Third, there is a tendency to pay everybody and anybody when there is a large amount of funding available. This can inadvertently undermine the equally important efforts of volunteers, many of whom work through NGOs. Empowerment does not necessarily mean having access to money.

To avoid these traps, try to spend one's research budget as if it were your own money. Having said this, I should add that I will usually build contingencies into my research budgets which are of the order of 20-30% of the estimated expenses. This contingency covers unforeseen circumstances related to emergencies or unanticipated opportunities. If, at the end of a project, you have unspent contingency funds, return them to the research pot for the next project or use them in some extension of the current project.

The Myth of Health and Safety

> "Successful field work inevitably requires that risks be taken."

Life is full of risks, but it is a myth that field work is inevitably riskier or more problematic than the daily activities in which we normally engage. Unfortunately, the frequency of accidents and misadventure appears high enough to give some credence to this. Most of the incidents can, however, be attributed to factors that are entirely within the researcher's control.

The most common cause of accidents is *lack of preparation*. As a researcher, you should be fully aware of all of the health and safety risks to which your team may be exposed, as well as learning in confidence any particular medical problems to which individual team members may be prone. Adequate funds need to be made available to equip and, if necessary, train team members in appropriate first aid procedures (as well as advanced aid and perhaps survival procedures if you will be in a very remote location). In the Bintuni Bay study, each team had access to basic emergency equipment at all times, as well as a range of first aid supplies; the total cost was approximately $500. Most of it was never used; all of the unused items (including others such as compasses, mosquito nets, and rubber boots) were left behind as a parting 'gift' to various villages when the field work was completed.

The second cause is *carelessness*. For some reason, many people who are normally very careful feel that they are protected by a guardian angel when they start to travel in the field. A leading cause of accidental death in developing countries is traffic accidents: use seatbelts; wear bright clothing at night; and, avoid travel at night if possible. For common health hazards, such as unclean water, malaria risk, or other diseases, appropriate personal precautions must be taken and followed. Two people in the Bintuni Bay study team contracted malaria because of failure to take the necessary tablets.

The third cause is *poor judgment*. I guarantee that there will, sooner or later, come a time when you will be faced with a choice between taking a health or safety risk and sacrificing part or all of your research program. Unless you have thought through this situation beforehand, and how you might deal with it, there is a great deal of pressure to take a risk. The most poignant

example I can think of occurred tragically in 1994 when two World Bank consultants and their Bolivian counterparts from the Environmental Agency were lost in the rainforests; they had decided to take a chartered plane in less than ideal conditions to fill in some details in their information requirements. They have never been found.

Coming to terms with the possible abandonment of a research program is, in my view, the only acceptable way of dealing with health and safety issues. To make it easier on myself, and on everybody in a research team, I outline and agree on – with fellow team members – any 'policies' and contingency actions that may be necessary. For example, I have a personal policy that I will under no circumstances travel in single engine air transport (including helicopters). This has, at times, meant foregoing spectacular flying trips, abandoning certain locations, spending extra time using other transport, or spending more money hiring a dual engine aircraft. In the case of the Bintuni Bay study, one of our two aircraft engines failed over the Cendrawasih Sea on our way to Bintuni, but we were able to return to base without incident. Another policy is that, where conditions dictate, I will line up contingency evacuation plans in the event of medical emergencies; these can be very expensive but, again, this is not a place to compromise. In Bintuni, the day before setting out into the field, we had contacted and had placed on standby three emergency services in the area who could have been contacted by radio in the event of emergency; the standby charge was modest and, had an emergency occurred, it would have used up all of the 'slack' funds in my budget.[3]

Study Implementation – Examples from Experience

To close, I will draw on some specific examples from the actual study process to show how the aforementioned methodological and logistical issues were addressed. The study itself occurred over approximately six months. The first phase of research preparation took about three months; this was followed by about two months of field work and then one month of final report-writing and dissemination.

Step 1 - Research Preparation

Obtaining necessary permits was a key activity during this phase. Research in many developing countries requires some form of local permission. In Indonesia, bona fide research requires a Surat Ijen (Research Permit) and, when traveling in militarily controlled areas such as Irian Jaya, a Surat Jalan (Travel Permit). Obtaining these documents typically takes one year for a research permit and, once that is in place, another three to six months for travel permission. The entire responsibility of obtaining these permits (quickly!) was delegated to an Indonesian counterpart with whom I worked for the entire study.

Development of methodology was the second major activity. Preliminary surveys were drafted with my counterpart based on surveys I had used elsewhere. I then provided funds to a local

[3] I treat my emergency 'slack' funds as the contingency amounts plus any undisbursed funds that would normally have been used to finish the project if no emergency had happened. In the case of Bintuni Bay, for example, about one-third of the total budget was actually allocated to travel and salaries for data reduction, data processing, and analysis after the 'isolated' field work component was finished. In the event of an emergency, I would simply have abandoned these tasks.

NGO that was linked into the Indonesian Environmental Study Center network (PSL) to contribute more questions to the survey and to field test the survey. The pilot test consisted of about a dozen households and substantial refinements were made to the questionnaire after this testing (see Annex). Linking into the PSL network was not an arbitrary decision; they are associated with all of the major universities in the country and the Bintuni Bay study was therefore able to ride on the coat-tails of an existing Research Permit that was held by one of the local universities. The local NGO was paid for time and expenses of all of the members involved in the field work, as well as for a few trips to Jakarta to work with the Government counterparts.

The third major activity involved a literature review and identification of potential data sources, particularly for forestry and fisheries. Confidential data were obtained from companies through interviews, and these were compared to 'official' statistics. Although the company and official statistics typically differed, they were within an adequate level of agreement to conform to the study's accuracy requirements.

The final activity, which started about a month before the field work, involved logistics relating to travel, money and health. We collectively settled on a formal field team of six individuals, working as two independent teams of three people each: two were foreign consultants; one was my local government counterpart; one was a representative from the local government planning office; one was a university researcher and local NGO member; and one was local NGO staff. An equipment pack was put together for each field team consisting of items such as notebooks, compasses, drawing equipment, sleeping bags, mosquito nets, flashlights, rubber boots and waders, and safety equipment. *One-way* tickets were issued by a local travel agent in Jakarta for travel to Manokwari, which is the closest major airport to Bintuni Bay, the capital of Manokwari District, and our designated 'staging' point for activities. One-way tickets were used because I prefer to encourage local businesses in the area where I do my research; all other travel was therefore organized and paid through a travel agent in Manokwari. (Travel agents are an often neglected resource for research teams but, when given the business, they are a valuable asset and can be an important contact point in dealing with emergencies.)

The field work required payments of approximately $10,000 in cash for airfares, individual per diems, group expenses (such as hiring boats), and contingencies. In Indonesian currency at that time, it would have filled about 2 small suitcases. To minimize risk of loss of the entire amounts, all individual per diems were prepaid to team members, services were prepaid wherever possible, and half of the funds were wired to a bank in Manokwari for collection upon arrival.

We left Jakarta, I should note, without our Surat Jalan.

Step 2 - Field Work

The two months of field work were themselves divided into a number of sub-tasks. First, a one week visit was made with key team members to Sulawesi to visit a number of mangrove sites and to get to know each other. This was an opportunity to discuss any final changes to the survey methods, as well as to review the general approach to the field work. Second, the entire team spent a week in Manokwari to gather 'official' data and to conduct training and orientation sessions for the local researchers. At that stage, the team split into two: three members covered

the north shore of Bintuni Bay from Bintuni on foot, and three members covered the south shore from Babo by boat. This comprised the actual field survey work that formed the basis of the household valuations. After this field work, the teams regrouped in Manokwari and then proceeded to the NGO headquarters in Ambon where most of the data analysis was conducted.

Setting a sample frame for any research study is an important task. The sample frame establishes who will, in fact, be surveyed. In the case of the Bintuni Bay area, there are 3000 households. We had established a need to cover at least 2% of these to get a minimally statistically meaningful sample for the purposes of our analysis. To achieve this, given that some households might be rejected, we set a target of 100 households. These 100 households were chosen at random. The survey would typically take a maximum of one hour per household, and the normal procedure was to allow one team member to conduct the surveys with an interpreter while the others worked on reducing the previous days' information or on mapping the village.

This study process reflects a number of principles that I have found useful to repeat in other exercises.

First and foremost, it is helpful to do as much as possible in the field. The survey form was designed in a way that summary statistics from every household surveyed could be generated every evening in a few hours. Doing this in the field allowed early identification of problems and, if necessary, resurvey of certain households to clear up any confusing issues.

Second, the surveyors kept careful track of quality control variables. The forms have a number of areas where 'information quality' is assessed at the end of an interview. In the end, some of the analysis relied on only about two-thirds of the surveys as one-third were discarded because of questionable quality.

Third, wherever possible, use local measures (such as 'headloads') and convert these later to other units as necessary. In doing this it is especially important, however, to note the potential seasonality of some crops; if valuation information is not collected carefully there is a tendency to mis-estimate results for seasonal activities.

Fourth, rely extensively on local expertise. Although our field teams were three people, each team hired at least one local interpreter in each village that was surveyed. The interpreter was typically selected after consulting with the local head of the village and the local police (who were always the first two contacted). In addition, we carried with us a letter of introduction from the local development planning office in Manokwari, who assisted us with compiling the official data.

Finally, money handling during the field work flowed through the local researchers, and at no time were respondents paid to participate in the survey. Small gifts were, however, carried that conformed to local norms. In most cases this involved packets of cigarettes, sugar or other foodstuffs. Any payments for local services (meals, interpreters, lodging) were made by the local researchers from the project funds to make it look like the 'outsider' was not in charge of the money.

We received our Surat Jalan by messenger on the last day of our field work. Its late arrival caused no problems for us, as we had always involved the local authorities in all of our work.

Step 3 - Follow-up Analysis and Dissemination

The most significant point to make about the follow-up analysis was that most of it was done before we returned to Jakarta. A room was rented in a local hotel in Ambon, where computers were set up and team members were shown how to enter and correct errors from the surveys. There were no surprises in the data at that time, because the data had already been tabulated manually in the field on a daily basis during the actual survey sessions. When the computer entry was completed, simple descriptive characteristics were generated and were summarized graphically.

The remaining more complex impact scenarios were modeled in Jakarta and final results were published in the form of an English and Indonesian executive summary. These summaries were presented at a workshop of senior decision-makers and others within one month of the completion of the field work. The results were also subsequently published in an Indonesian journal about a year before the official English version of the study was published by EMDI.

Step 4 – The Reality Check

A final exercise that must be done by every researcher is a *methodological reality check* on the results. The intuitive test essentially asks the question: "Knowing what is known now, is the methodology that was used indeed appropriate for this type of analysis?" In the case of Bintuni Bay, for example, the total annual value of the resource represented about 10% of the value of the regional economy. Under such circumstances, the simple shadow pricing rules that were used in the study are actually questionable because, recalling cost benefit analysis theory, these shadow prices assume that any project intervention is marginal and will not in fact effect prices in the local economy. As soon as projects or interventions become relatively 'large', different (and much more complex) shadow pricing methods are necessary. I judged at the time that the 10% figure was consistent with annual growth in some parts of the economy, and hence I did keep using the simplified shadow pricing assumptions. Had the resource value been much larger, however, then I might have reconsidered the methodology.

Conclusions - A Retrospective

Research as a Transparent Process

Experience at Bintuni Bay and elsewhere convinces me that there are generally no 'correct' or 'incorrect' choices when it comes to selecting methodologies or to applying analytical methods. Most of these choices should reflect explicit tradeoffs between issues such as: process versus product; data quality versus data requirements; or, precision versus accuracy. For the most part, the research exercise should itself be a transparent process of decision-making on the part of the researcher. I say 'for the most part' because *human health and safety* is one area in which I believe no compromises should be made, yet, as noted, I have seen numerous occasions where it was blatantly neglected to everyone's peril.

More on Health and Safety

I have often been asked if there are major things that I do differently now than I did at Bintuni Bay and earlier research work. To answer that, I need to recount some other experiences I have had while working in sub-Saharan Africa and Southeast Asia on various projects.

Over the past five years I have watched, in Southeast Asia, 'official' AIDS statistics climb faster than any other economic, social or environmental indicator that is reported. In West Africa, I have lost track of the number of times that a meeting has been canceled or missed by a key policy-maker because he has had to travel to his village to attend the death of a friend or relative who has succumbed to AIDS. In Guinea-Bissau, where I assisted drafting an environmental action plan, I watched helplessly as AIDS incidence among children at birth is on an alarming increase, while the life expectancy for individuals in the country as a whole is in fact declining because of AIDS. Last year, while in Uganda, our official Government counterpart died from AIDS between our original reconnaissance visit and our intended main research work; he was responsible for designing an energy conservation strategy for the country. And these are not isolated stories.

In 1992 I attended a lecture, in Jakarta, sponsored by the World Health Organization and the UNDP, where one of the speakers made a plea to all field researchers to "ensure that they do not contribute to the rising incidence of AIDS." A list of suggestions were given, many of which I have since tried to follow in my field work. Generally, the tactics must involve adjustments to individual behaviour as well as adjustments to the overall conduct of the research program.

At an individual level, all team members should be aware of the risks of AIDS in the particular area they are working, and they should take appropriate personal precautions. The 'leader' of any research program should take on the responsibility of ensuring that everybody is, in fact, aware of the risks, although he or she obviously can not police everybody's actions 24 hours a day.

Adjustments can and should, however, be made to the overall field work strategy. WHO evidence suggests that one of the groups at greatest risk to contracting and spreading AIDS is *traveling or sojourning men with money*. On my current research projects in 'high risk' areas, the types of 'adjustments' I have made have therefore been manifold. First, I no longer distribute large sums of discretionary funds to people while they are traveling; payment is either made well in advance of the traveling (which gives them an opportunity to leave a substantial portion of their per diems or honorariums at home) or after the work is finished. Second, I try to organize research work for survey gathering as day trips out of the local researchers' home base or, if that is not possible, as a series of short trips. My experience has shown that this typically will increase travel time and local costs by 50% to 100%. The first response of funding agencies is often to balk but, once the reasons are explained, I have never encountered any resistance. Third, where extended field work is necessary, research budgets should accommodate extra expenses for the local researchers to return home frequently or to bring the families to the research location.

Finally, all junior support personnel (drivers, interpreters, local guides) that are associated with a research project should be afforded due considerations for their health and safety. Oddly, this is often one of the most difficult to implement because it is customary in many countries simply

to give drivers some money for the night and to let them find their own accommodation. I have, on one occasion, put my driver in a five star hotel when I was not satisfied that he would find an appropriate refuge. Needless to say, such moves are not always popular with project budget officers but they are, in my view, entirely justifiable. In short, this is simply another example of the adage "never ask anyone to do anything that you would not do yourself."

Postscript – Dear Diary ...

This paper has dwelled on how to avoid or address a number of methodological and logistical pitfalls and problems. In closing, however, I believe that all such research should also be fun. The field work experience provides ample opportunities for discovering new aspects of our environment and how we react and respond to it. During the Bintuni Bay study, and in others since then, I have gotten into a habit of keeping a personal journal on the events of the day. I will, therefore, leave the last words to an extract from that journal, written while in the Bintuni Bay mangrove:

> 20-3-91.1700: Run aground on a sandbar trying to enter a narrow river ... will wait for tide to lift us. Bintuni Bay is big and beautiful now ... the sun sets quietly as birds and frogs harmonize in the background mangrove.
>
> 20-3-91.1830: Tide raises us off sandbar and we slowly make our way via a 3 kilometer stretch of 10 meter wide river ... snaking into the mangrove forest dead slow. It's dark ... a crescent moon is above us ... truly one of my most spectacular experiences here. We arrive in Saengga one hour later amidst lots of excitement, dancing and drumming.
>
> 22-3-91.1430: We are now eight hours out of Saengga and I just now discovered that I have been sharing my boat - the Angelus III - with two young buaya, each about 1 meter long, crammed into a cage which has been serving as a backrest. I think the species of buaya we have here is crocodilus ferocus - or buaya laut as they call it. I learned from our surveys that it is a relatively important commodity in the mangroves - it is eaten on rare occasions - but is usually sold to seafarers live who trade them around to people who try to breed them for skins. There are two particularly big crocodiles behind one of the houses in Bintuni. The male - named Herman - is certainly as big as any of the Nile crocodiles I've seen ....

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Any opinions and conclusions expressed herein are those of the author, who takes full responsibility for any errors of commission or omission.

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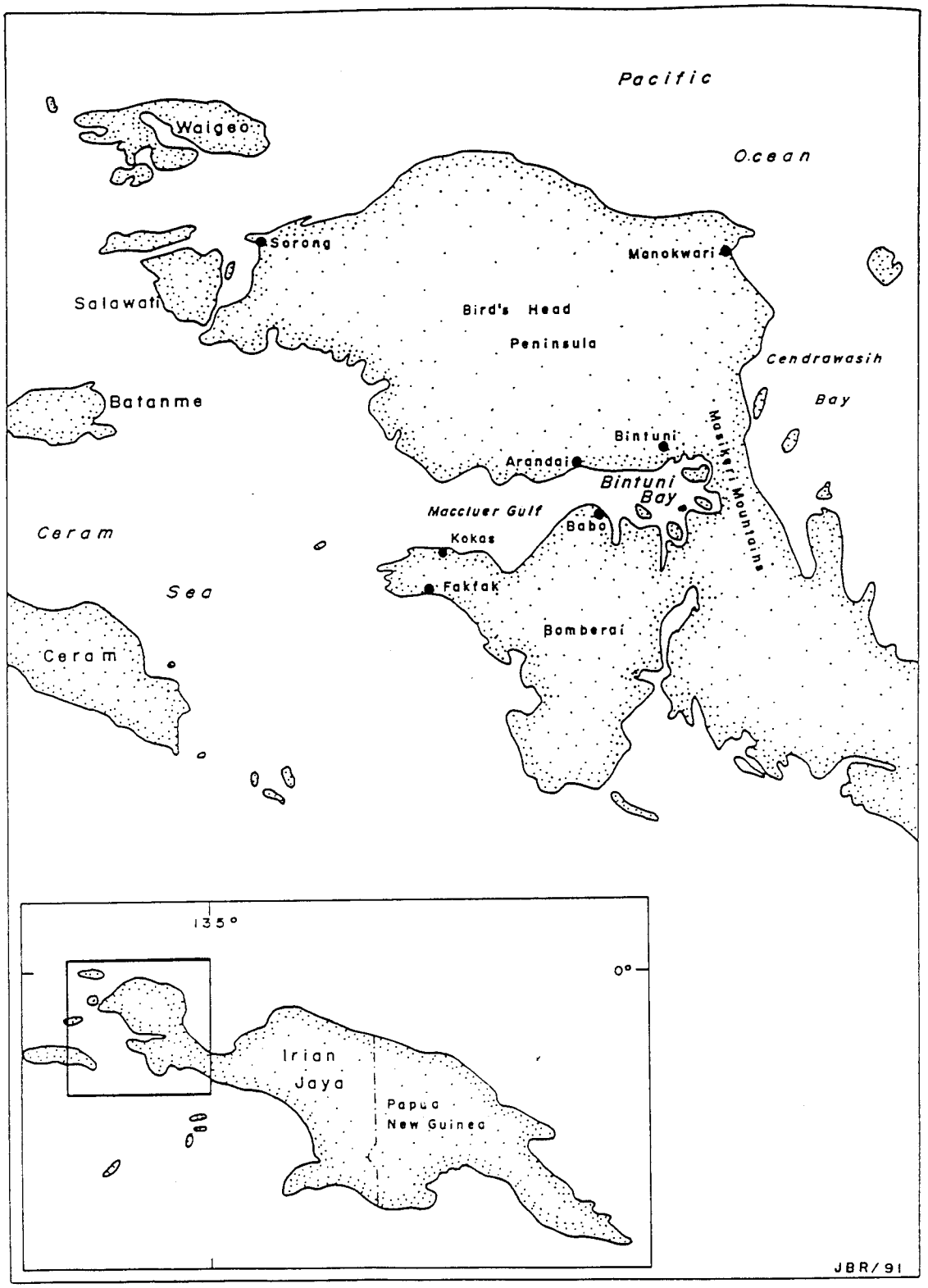
Map 1



Map 1. Location map of Bintuni Bay, Indonesia

ANNEX. HOUSEHOLD SURVEY INSTRUMENT (ENGLISH)

The English translation of the household survey instrument used for the survey in the Bintuni Bay vicinity in March, 1991, follows. The "internal use codes" on the first page of the survey were coded as shown in Figure A.1.

Figure A.1
Definition of Survey Internal Use Codes

A	B	C	D	E	F	G	H
I	J	K	L	M	N	O	P
Q	R	S	T	U	V	W	X
Y	Z	AA	AB	AC	AD	AE	AF
AG						AI	AJ

Field	Variable	Description
A	SURVEY	Survey number (1-101)
B	HHCODE	4 digit household code (abcd); a=interviewer (1-6); b=village (1-7); cd=map
C	QUALITY	Interviewer ranking of respondent quality (1-4)
D	WHO	Relationship of household head to person interviewed (1-3)
E	FROM	Household head born locally (1) or moved to village (2)
F	INCOME	Respondent's estimate of household income ('000 Rp/year)
G	PROD	Share of trade produced (0-100%)
H	BARTER	Share of trade bartered (0-100%)
I	POPEQ	Household population (adult male consumption equivalence)
J	POPTOT	Household population normally present
K	POPM	Household male population normally present
L	POPAD	Household adult population normally present
M	ADMALE	Household adult male population normally present
N	EDHEAD	Years of education of household head
O	EDTOT	Total years of education by all household members normally present
P	POPABS	Household population who migrated away over past 5 years
Q	FARM	Calculated annual household income from farming ('000 Rp)
R	STOCK	Calculated annual household income from livestock ('000 Rp)
S	HUNT	Calculated annual household income from hunting ('000 Rp)
T	FISH	Calculated annual household income from fishing ('000 Rp)
U	GATH	Calculated annual household income from gathering ('000 Rp)
V	MANUF	Calculated annual household income from manufacturing ('000 Rp)
W	WAGE	Calculated annual household income from wages ('000 Rp)
X	ABSENTEE	Calculated annual household income from absentee transfers ('000 Rp)
Y	MISC	Calculated annual household income from miscellaneous sources ('000 Rp)
Z	AYAM	Calculated annual household income from chicken ('000 Rp)
AA	BUAYA	Calculated annual household income from hunting crocodile ('000 Rp)
AB	IKAN	Calculated annual household income from fish ('000 Rp)
AC	UDANG	Calculated annual household income from shrimp ('000 Rp)
AD	SAGU	Calculated annual household income from sago ('000 Rp)
AE	ROYALTY	Calculated annual household income from royalties ('000 Rp)
AF	RUSA	Calculated annual household income from hunting deer ('000 Rp)
AG	BABI	Calculated annual household income from hunting wild pig ('000 Rp)
AI	SAMEAS	Team leader quality control variable (0=okay; 1=warning)
AJ	MIGRATE	Years ago household head moved here if FROM=2

RESPONDENT NUMBER: _____

INTERVIEWER INITIALS: _____

BINTUNI BAY, IRIAN JAYA

I. HOUSEHOLD CHARACTERISTICS

Village: _____ Location on Map: _____

Date of Interview: _____, 1991

Name of Person Interviewed: _____

Relationship to Household Head:

1. Self (HHHead)
2. Husband/Wife
3. Other:_____

Name of Household Head (HHHead): _____

How long has HHHead been here?

1. Born in Desa
2. Moved to Desa from _____
   , _____ years ago.

Other Comments:

for office use:

II. HOUSEHOLD COMPOSITION

Information about household members Normally Present

Relation	Sex (Male/Female)	Age (years)	School (years)	Married? (Yes/No)	Occupation
HHHead	__	__	__	__	_____
Spouse: ____	__	__	__	__	_____
Spouse: ____	__	__	__	__	_____
Child: ____	__	__	__	__	_____
Child: ____	__	__	__	__	_____
Child: ____	__	__	__	__	_____
Child: ____	__	__	__	__	_____
Child: ____	__	__	__	__	_____
Child: ____	__	__	__	__	_____
Other: ____	__	__	__	__	_____
Other: ____	__	__	__	__	_____
Other: ____	__	__	__	__	_____

Number of Other Members of Household Normally Absent:

How many are absent : In School [#]: _____

How many moved away in last 5 years to work [#]: ____ (moved to [location]: _____)

How many are absent for other reasons [#]: ___ (Reason: 1. _____)

(Reason: 2. _____)

Surveyor Comments.

III. HOUSEHOLD INCOME & ASSETS

Household Income Estimate:	Rp_____/(year/month/week)
Number of Planted Farms (#; area):	Size: _____
Are the planted farms:	1. Owned by the individual household? 2. Owned by a group of households? # __ 3. Borrowed?/Rented? ("rented = menyewa") [Surveyor indicate which one]

How much time does it take to travel to planted farms: _____ hours (one direction)

Is the household self-sufficient?	Yes/No	
How much of what the household uses or eats is:	Produced by household:	_____%
	Bartered for with goods:	_____%
	Paid for with money:	_____%

Surveyor Comments:

IV. PLANTED CROPS

for office use

What are the three most important crops which you sell?:

Name	Quantity	Price	Value	
1. _____	_____ __/ (week/month/year)	_____/__	_____ (week/month/year)	_____ (Rp/year)
2. _____	_____ __/ (week/month/year)	_____/__	_____ (week/month/year)	_____ (Rp/year)
3. _____	_____ __/ (week/month/year)	_____/__	_____ (week/month/year)	_____ (Rp/year)

Comments (regarding seasonality):

What are the most important crops which you use yourself?:

Name	Quantity	Name	Quantity
1. _____	_____ __/ (week/month/year)	4. _____	_____ __/ (week/month/year)
2. _____	_____ __/ (week/month/year)	5. _____	_____ __/ (week/month/year)
3. _____	_____ __/ (week/month/year)	6. _____	_____ __/ (week/month/year)

V. MEAT

for office use

What are the most important meats which you sell?:

Name	Quantity	Price	Value	for office use
Livestock				
1. _____	_____ __/ (week/month/year)	_____/__	_____ (week/month/year)	_____ (Rp/year)
2. _____	_____ __/ (week/month/year)	_____/__	_____ (week/month/year)	_____ (Rp/year)
Hunting/Trapping				
1. _____	_____ __/ (week/month/year)	_____/__	_____ (week/month/year)	_____ (Rp/year)
2. _____	_____ __/ (week/month/year)	_____/__	_____ (week/month/year)	_____ (Rp/year)
Fishing (includes shrimp & other crustaceans)				
1. _____	_____ __/ (week/month/year)	_____/__	_____ (week/month/year)	_____ (Rp/year)
2. _____	_____ __/ (week/month/year)	_____/__	_____ (week/month/year)	_____ (Rp/year)
3. _____	_____ __/ (week/month/year)	_____/__	_____ (week/month/year)	_____ (Rp/year)
4. _____	_____ __/ (week/month/year)	_____/__	_____ (week/month/year)	_____ (Rp/year)

What are the most important meats which you use yourself?:

Name	Quantity	Name	Quantity
1. _____	_____ __/ (week/month/year)	3. _____	_____ __/ (week/month/year)
2. _____	_____ __/ (week/month/year)	4. _____	_____ __/ (week/month/year)

How far do you travel to HUNT/TRAP? __ hours
How long do you stay away when you HUNT/TRAP? __ days
How many from your household go when you HUNT/TRAP? __

How far do you travel to FISH? __ hours
How long do you stay away when you FISH? __ days
How many from your household go when you FISH? __

Surveyor Comments:

VI. NATURAL PRODUCT GATHERING/MANUFACTURING

for office use

What are the most important products which you gather & sell?:
[fuelwood, timber, sago, fruits, medicines,...?]

Name	Quantity	Price	Value	
1. _____	_____ __/ (week/month/year)	_____/__	_____ (week/month/year)	_____ (Rp/year)
2. _____	_____ __/ (week/month/year)	_____/__	_____ (week/month/year)	_____ (Rp/year)
3. _____	_____ __/ (week/month/year)	_____/__	_____ (week/month/year)	_____ (Rp/year)
4. _____	_____ __/ (week/month/year)	_____/__	_____ (week/month/year)	_____ (Rp/year)

What are the most important products which you manufacture & sell?:
[alcohol, charcoal, cane products, rattan, ...?]

Name	Quantity	Price	Value	
1. _____	_____ __/ (week/month/year)	_____/__	_____ (week/month/year)	_____ (Rp/year)
2. _____	_____ __/ (week/month/year)	_____/__	_____ (week/month/year)	_____ (Rp/year)
3. _____	_____ __/ (week/month/year)	_____/__	_____ (week/month/year)	_____ (Rp/year)

Surveyor comments:

VII. MISCELLANEOUS INCOME

Does your household have income from the following sources or activities?:

Source	Frequency	Amount	Value	for office use
Wages or Salaries				
1. _____	_____ __/ (week/month/year)	Rp _____	_____ (week/month/year)	_____ (Rp/year)
2. _____	_____ __/ (week/month/year)	Rp _____	_____ (week/month/year)	_____ (Rp/year)
Gifts from Absent Family				
1. _____	_____ __/ (week/month/year)	Rp _____	_____ (week/month/year)	_____ (Rp/year)
2. _____	_____ __/ (week/month/year)	Rp _____	_____ (week/month/year)	_____ (Rp/year)
Gifts from Others (Church, for example)				
1. _____	_____ __/ (week/month/year)	Rp _____	_____ (week/month/year)	_____ (Rp/year)
Other				
1. _____	_____ __/ (week/month/year)	Rp _____	_____ (week/month/year)	_____ (Rp/year)

VIII. FINAL QUESTION (TIME PERMITTING)?

What are the major economic problems faced by the household?

1. _____
2. _____
3. _____

IX. FINAL OBSERVATIONS ABOUT ASSETS (BY SURVEYOR)

What are the major assets which the household appears to have inside the household?
(Radio, watches, ...)

X. ASSESSMENT OF QUALITY OF ANSWERS (BY SURVEYOR)

1	2	3	4
poor	better	okay	very good