World Agroforestry Centre
TRANSFORMING LIVES AND LANDSCAPES

RUPES
Rewarding Upland Poor for Environmental Services

An Outline of Requirements for a Spatial Information and Negotiation Support System

Consultancy Report for the Rewarding Upland Poor for Environmental Services (RUPES) Program

Final Draft for External Comments

Prepared by
Luke Hanson (Consultant)
World Agroforestry Centre

November 2003

1. Introduction

This report describes the outcomes of a 45-day consultancy undertaken for RUPES, from August to November 2003. The purpose of the consultancy was to investigate the design requirements for a RUPES spatial information and negotiation support system (SINSS). Such a system would allow standardized and consistent assessment of RUPES action research sites and outcomes, and promote transparent and informed negotiation between stakeholders involved in the development of environmental service rewards schemes (ESRSs). It would also establish an important baseline for spatial targeting, impact monitoring and adaptive management.

The tasks of the consultancy were to: (1) determine the types of landscape, land use and livelihoods data required for a SINSS; (2) investigate the availability of such data for the Kalahan (Philippines) and Kulekhani (Nepal) sites; (3) assess the quality of such data through short field visits and consultation with local specialists; (4) assess the capacity of RUPES site implementers to collect and analyze missing or low-quality data; and (5) explore further partnership and funding possibilities for RUPES through consultation with government agencies, NGOs and donors. These tasks were undertaken through literature compilation and review (6 days), travel and fieldwork preparation (4 days), travel (5 days), field site visits (6 days), data search and assessment (8 days), partner and donor consultations (8 days), concept note preparation (4 days) and report preparation (4 days).

The first section of the report describes issues related to the Kalahan and Kulekhani sites, arising from close consultation with partners and site visits (these were the first official RUPES visits to the sites and thus the first chance to review the approved RUPES proposals in context). The second section outlines the data requirements for a SINSS, describes the extent to which data is available for the Kalahan and Kulekhani sites, and makes recommendations for future data collection and analysis. The final section provides some cost estimates and recommendations for the development of a SINSS.

2. Brief overview of issues arising from field visits

2.1 Kalahan

The Kalahan Reserve (KR) is 15,000 hectares of mountainous terrain (600-1700 meters asl) in the southwest of Nueva Vizcaya Province in the Philippines (KEF RUPES Proposal, 2003). The KR comprises three agroecological zones that have been managed under the direction of the Ikalahan community organization, the Kalahan Education Foundation (KEF), since 1974. The eastern zone is a multiple use landscape of community forests and low intensity swidden gardens (planted with fallow improving species such as Nepalese Alder), with small areas of irrigated rice cultivation on narrow alluvial terraces. The middle zone is an upper slope wildlife sanctuary for over 40 endangered species and remnant patches of Oak forest. The western zone is a largely abandoned and degraded landscape of Pine woodlands and grasslands.

The KEF has coordinated the reforestation of much of the eastern zone (roughly 5000 hectares) over the last 20 years through a strongly controlled and regulated community forestry program (e.g. KEF foresters inspect and approve community land management activities with the backing of the Ikalahan tribal elders). The forests produce timber for local use and fruits for the KEF food processing plant that makes a variety of jam products (under the Mountain Fresh label) for major supermarkets in Manila. The revenues from this business fund the local school, health center and extension service.

The food processing business provides financial support to a significant proportion of households (over 200) within the KR, through either wage employment or payments for services (planting, harvesting, transport etc.).

The KEF claims that reforestation has improved water quality in local rivers and increased dry season stream flow. The KEF also claims that reforestation has sequestered large amounts of carbon. This is supported by 15 years of forest inventory data from 130 sample plots within the KR (pers. comm., Delbert Rice, KEF). The wildlife sanctuary supports some of the last remaining patches of Oak forest in the Philippines, along with over 40 endangered fauna species (KEF RUPES Proposal, 2003).

The provision of watershed, carbon sequestration and biodiversity services from communities within the KR make it a useful, but in some respects unique, RUPES research site. It's strength, and distinctiveness, lies in the firm and fair control that the KEF and Ikalahan tribal elders have over the community, particularly with respect to land management, which is reinforced by the conditions of the 1999 Ancestral Domain Title (that requires the watershed to be protected in return for community title). However, some of the other necessary factors are less than ideal and pose significant challenges.

Even if reforestation has improved water quality and increased dry season stream flow, the nearest potential 'buyer' of such watershed services is over 60 km downstream. This distance is enough to ensure that any water 'product' that flows out of the KR would, most likely, be degraded by the time it reaches the Magat Reservoir (the KR comprises roughly 1% of the Magat Reservoir catchment area). Therefore, there may be limited prospects for the KR communities to sell their watershed services, outside of more innovative approaches such as building a pipeline to the base of the KR for a domestic water supply scheme or bottling water within the KR (an idea that was explored and rejected by KEF in the 1980's).

There are good prospects for carbon sequestration service rewards, as KEF has inventory data on tree (Pine, Oak, Alder and Dipterocarp) growth rates (and thus carbon sequestration rates) under different management regimes. However, given the conditions of the Kyoto Protocol and Clean Development Mechanism, KEF may have to attempt to negotiate an independent agreement with a carbon producer. This will be a difficult task without high-level facilitation and support (presumably from the RUPES network within the Philippines).

Recommendation 1: RUPES should provide more technical support to KEF to assist with the quantification of tree growth and carbon sequestration. This could be provided by a partner in the RUPES consortium, or more realistically, by a RUPES employee, consultant or affiliated doctoral student. These options need further investigation by RUPES management.

There are some prospects for biodiversity service rewards. Among the many potential 'buyers', one obvious possibility would be Conservation International (who have defined Luzon as one of their global priority 'hot spots' for conservation activities). However, despite the rhetoric, cases of international NGOs funding ESRSs are limited, and may remain that way depending on how enthusiastic or capable NGOs are to make the type of long-term funding commitments (or single large payment) required for an ESRS. Also, it is not clear whether KEF would be prepared to compromise its 'multiple use' approach to biodiversity (pers. comm., Delbert Rice, KEF) within the KR wildlife sanctuary.

In summary, the Kalahan site is in an unusual situation with respect to the RUPES Program. Much of the human-settled landscape (eastern zone) has been reforested or is cultivated using a range of

regulated 'best management' practices, reinforced through strict community control. The wildlife sanctuary (middle zone) is also well managed. The resource security (particularly for non timber forest products such as fruit) provided by good land management has allowed the food processing business to prosper, and thus raise the standard of living within the KR through wage employment and improved education and health services. The challenge for KEF is that, in many respects, they are up to 20 years ahead of the RUPES model, in terms of rewarding the community for restoration and maintenance of environmental services. Further rewards are possible through, most likely, carbon sequestration payments, but there are still numerous hurdles in the international carbon trading market.

Recommendation 2: If KEF is unsuccessful in negotiating an ESRS for the KR, the site should remain part of the RUPES network for research and demonstration purposes. KEF are a good partner for RUPES as they have demonstrated capacity to initiate and support ESRSs in the upland Philippines, based on land tenure rewards in return for watershed protection (through the Ancestral Domain model).

2.2 Kulekhani

The Kulekhani Watershed (KW) is 12,000 hectares of mixed terrain (1400-2300 meters asl) in Makwanpur District of central Nepal (WN RUPES Proposal, 2003). The striking difference between KW and surrounding watersheds is the good condition of land, forest and water resources. In many respects, KW is close to a 'model' watershed. Most upper slopes and ridges (upper zone) have been reforested and the majority of lower slopes (mid zone) are terraced. The only active degradation areas appear to be in the drainage lines (riparian zone) and in numerous steep but low relief gorges immediately above major drainage lines (lower zone). While small landslides in the upper and mid zones have been controlled through reforestation and terracing, large slope failures remain a threat. This is due to the combination of active geomorphic processes (uplift and earthquakes) and monsoonal rainfall (most of the 2500 mm annual rainfall falls between June and September). In the early 1990's, a major landslide destroyed the previous Kulekhani Reservoir.

Sedimentation in Kulekhani Reservoir remains a problem for the reservoir managers and associated hydroelectric scheme run by the Nepal Electricity Authority (NEA) (WN RUPES Proposal, 2003). However, it is not clear whether the bulk of this sediment originates in the upper catchment or in the immediate hills around the reservoir. Given the rigorous soil conservation practices in the upper and mid zones, it is unlikely that upper slope erosion would contribute much to the total sediment load. From field observation and speculation, land degradation in the lower and riparian zones appears to be the major source of 'current' sediment.

Low 'dry season stream flow' is also a concern for the NEA (WN RUPES Proposal, 2003). However, this is more a reflection of the seasonal rainfall pattern within the KW. Given the extent of forest cover in recharge areas (in the upper zone) and terraces on sloping land (in the mid zone), the level of 'buffering' is already high compared to surrounding watersheds dominated by degraded grasslands. In this respect, maintenance of forest cover and terraces is an important priority for maintaining current levels of dry season stream flow. It could be argued that removal of forests or terraces (and thus sources of buffering) could further reduce dry season stream flow.

Based on the acknowledged presence of problems associated with 'sedimentation' and 'low dry season stream flow' in the Kulekhani Reservoir, combined with a range of well-managed to poorly-managed landscape zones, the KW offers good prospects for establishing an ESRS. An added benefit is that

large amounts of data (of mixed quality) have been collected for KW by the European Union (EU) funded Bagmati Integrated Watershed Management Program (BIWMP). However, this program has recently finished and the new 'owner' of the program outputs, the Department of Soil Conservation and Watershed Management (DSCWM), has unknown policies about data exchange or sales.

Recommendation 3: Senior staff from Winrock Nepal (WN), BIWMP and DSCWM should meet as soon as possible to clarify issues about data exchange, associated costs and conditions of use.

The first technical challenge for WN and RUPES is to quantify the location of sediment sources in the landscape and determine to what extent the causal erosion processes are natural versus human-induced. If they are mostly natural (from extreme rainfall events leading to major landslides) then WN have little chance of convincing the potential environmental service 'buyer' (NEA) to invest in an ecological solution (as opposed to reservoir dredging and expansion). The Act has specified a formula for calculating royalty based on the capacity of hydroelectric plants and energy production (roughly 2.5% of the revenue from hydroelectric plants). Ten percent of this royalty is sent to the district government but it is unclear how this money is spent and the district has not prioritized Kulekhani watershed in spending money (one possibility for WN is to facilitate the reallocation of these funds to priority community groups). If the erosion processes are mostly human-induced (and human-controllable) then WN have a good chance of convincing NEA to invest in an ESRS. So quantification of sediment sources and erosion processes is the critical first step.

The second challenge for WN and RUPES is to demonstrate that the present level of forest cover and terracing is contributing to relatively high dry season stream flow (contrary to the perceptions of NEA and other agencies). Hydrology modeling is needed to quantify the impact of forests and terraces on seasonal stream flow, and ultimately to convince NEA that supporting the maintenance of forests and terraces, under a 'business as usual' scenario, is in their best interests.

Recommendation 4: Given that WN have limited capacity and funds for this type of modeling, RUPES should support such activities through other mechanisms, possibly through collaboration with the International Centre for Integrated Mountain Development (ICIMOD), who has good technical capacity in watershed modeling and monitoring.

There are other challenges for WN and RUPES. If an ESRS is negotiated with NEA, then the rewards must be channeled to those land managers (or community groups) in the watershed who have the most efficient and effective impact on either maintaining or restoring watershed services (while maintaining acceptable levels of equity within the broader community). This strategic prioritization process must be successful to ensure that sediment loads and dry season stream flow are maintained (or improved) over time - an impact that the NEA will need to continue funding the scheme. Again, based on field observation and speculation, the hypothesized priority focus areas appear to be the upper zone forests (maintaining forest cover through rewards to forest user groups), the lower zone slopes (controlling land degradation into drainage lines through rewards to individual land managers), the riparian zone (controlling land degradation through rewards to individual land managers) and all zones in the immediate proximity of the reservoir.

WN has limited capacity to undertake this type of analysis. As emphasized by local watershed management specialists, the initial critical step for WN is the quantification of sedimentation and seasonal stream flow to convince the NEA to enter negotiations about an ESRS for KW.

Recommendation 5: WN and RUPES should work together to review the RUPES Work Plan, budget allocations and partnerships (to improve capacity in required technical areas).

3. RUPES spatial information and negotiation support system

Quantification of environmental services, negotiation of ESRSs and, ultimately, monitoring the impact ESRSs on the livelihoods of participating communities, requires baseline data on landscapes, land use and livelihoods. While each RUPES research site has a set of relatively unique conditions, 'action research' is best undertaken using standardized assessment methods that allow consistent and repeatable analysis within and between sites.

3.1 Data requirements

The following data are suggested for a RUPES spatial information and negotiation support system (SINSS). These suggestions are based on the review of the RUPES Program Design Document, the RUPES site proposals and site visits to Kalahan (Philippines) and Kulekhani (Nepal). Note that further investigation is required to identify the most appropriate survey methods for each parameter and appropriate indicators for monitoring.

Landscape data

Climate data (seasonal rainfall, temperature, humidity, wind, light and evaporation) over a 10-year period (at least) is recommended for understanding hydrology, land capability and land degradation processes (for quantifying and monitoring watershed services).

Topography data (contours) at a scale of 1:25,000 is recommended for understanding geomorphology, hydrology, land capability and land degradation processes (for quantifying and monitoring watershed services).

Geology data (rock types and lithology) at a scale of 1:50,000 is recommended for understanding soil formation and degradation processes (for quantifying and monitoring watershed services).

Soil data (soil types, physical properties, chemical properties and biological properties) at a scale of 1:25,000 is recommended for understanding geomorphology, hydrology, land capability and land degradation processes (for quantifying and monitoring watershed services).

Land evaluation data (land systems, land capability and land erosion) at a scale of 1:25,000 is recommended for understanding land use and land degradation processes (for quantifying and monitoring watershed services).

Forest data (structure, floristics and growth rates) at a scale of 1:25,000 is recommended for understanding hydrology and land degradation processes (for quantifying and monitoring watershed services) and forest growth rates (for quantifying and monitoring carbon sequestration services).

Biodiversity data (flora and fauna) at a scale of 1:25,000 is recommended for quantifying and monitoring biodiversity services.

Water data (seasonal stream flow and turbidity) over a 10-year period is recommended for understanding hydrology and geomorphology processes (for quantifying watershed services).

Land use data

Satellite imagery (Landsat TM is the best value) at a scale of 1:50,000 is recommended for establishing a geographic base map for other thematic data, as well as monitoring changes in land cover (for quantifying and monitoring watershed, carbon sequestration and biodiversity services).

Land cover data at a scale of 1:50,000 is recommended for understanding hydrology and land degradation processes (for quantifying and monitoring watershed and carbon sequestration services).

Land use and management data (intensity, practices and products) at a scale of 1:25,000 is recommended for understanding land restoration and degradation processes (for quantifying and monitoring watershed services).

Land tenure data at a scale of 1:25,000 is recommended for identifying and prioritizing individuals, households or community groups for environmental service reward schemes, as well as monitoring the impact of reward schemes.

Livelihoods Data

Population data (totals, density and change) at a scale of 1:25,000 is recommended for identifying and prioritizing individuals and households for ESRSs, as well as analyzing trends and scenarios related to population pressure.

Household income, expenditure and poverty data at a scale of 1:25,000 is recommended for identifying and prioritizing households for ESRSs (with the duel purpose of alleviating poverty), as well as monitoring the impact of reward schemes (if income generation or direct payments are part of a reward package).

Education data at a scale of 1:25,000 is recommended as a baseline for monitoring the impact of reward schemes (if education services are part of a reward package).

Health data at a scale of 1:25,000 is recommended as a baseline for monitoring the impact of reward schemes (if health services are part of a reward package).

Infrastructure data at a scale of 1:25,000 is recommended as a baseline for monitoring the impact of reward schemes (if infrastructure services are part of a reward package).

Social capital data at a scale of 1:25,000 is recommended as a baseline for monitoring the impact of reward schemes (if social capital services are part of a reward package).

3.2 Data Availability for Kalahan

Climate: KEF had an official Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA) weather station at Imugan for 2 years (1990's) and thus has records of daily rainfall, temperature, humidity, wind and evaporation. Reliable applications of these data are

constrained by the short time series and likely rainfall gradients within the KR (decreasing from east to west and from high to low elevations, based on field observations of vegetation structure and floristics). Regional scale climate data can be obtained from PAGASA, which is part of the Department of Science and Technology.

Topography: KEF has one copy of the relevant 1:50,000 map sheet (Sheet name: San Nicolas, Sheet number: 7175 II, Contour interval: 20 meters) and no digital data. The map sheet is presently unavailable in digital format, although there is some chance that the National Mapping and Resource Information Authority (NAMAIA) will digitize it in 2004.

Geology: KEF has no geology data for the KR. The Philippines Bureau of Mines and Geosciences has 1:250,000 geological data for the KR.

Soil: KEF has no formal soil data for the KR. The Philippines Bureau of Soil and Water Management (Department of Agriculture) has 1:250,000 soil data for Nueva Vizcaya Province. However, at this scale the data is of limited use to RUPES activities.

Land evaluation: KEF has no land evaluation data for the KR. The Philippines Bureau of Soil and Water Management (Department of Agriculture) has 1:250,000 land capability data for Nueva Vizcaya Province. However, at this scale the data is of limited use to RUPES activities.

Forest: KEF has spatial data on forest types for the KR (collected in collaboration with David de Vera from the Philippine Association for Intercultural Development). KEF also has forest inventory data for 130 plots throughout the KR. These data will be useful for attempting to quantify rates of carbon sequestration under different management regimes.

Biodiversity: KEF has fauna and flora data (presence and abundance) for the KR.

Water: KEF has no data on seasonal stream flow or turbidity and there is no useful data at provincial or national scales.

Satellite imagery: KEF has no satellite images of the KR. Low-cost Landsat images from 1995-1997 may be available through the Database Management Department of NAMAIA (resulting from the UNDP funded 'Philippine Land Use and Land Cover Change case Study Project'). Contact Veneracion Reynoso (vereynoso@yahoo.com). Other images are available through the normal range of national and international suppliers.

Land cover: KEF has no formal land cover data, although the map of 'forest types' is effectively a map of land cover. There is no useful data at provincial or national scales.

Land use and management: KEF has no spatial data on land use and management and there is no useful data at provincial or national scales.

Land tenure: KEF has no spatial data on land tenure.

Population: The National Statistics Office (www.census.gov.ph) has data on population totals, density and migration for Nueva Vizcaya Province, although the quality of this data is unknown. The Database Management Department of NAMAIA (through the UNDP funded 'Philippine Land Use and

Land Cover Change Case Study Project') has population data for Sante Fe District (with some chance of sampling points being located within KR).

Household income, expenditure and poverty: The National Statistics Office has data on household income, expenditure and poverty for Nueva Vizcaya Province (through the 2000 Family Income and Expenditure Survey), although the quality of this data is unknown. The Database Management Department of NAMAIA (through the UNDP funded 'Philippine Land Use and Land Cover Change Case Study Project') has household income, expenditure and poverty data for Sante Fe District (with some chance of sampling points being located within KR).

Education: The National Statistics Office has education data for Nueva Vizcaya Province, although the quality of this data is unknown. The Database Management Department of NAMAIA (through the UNDP funded 'Philippine Land Use and Land Cover Change Case Study Project') has education data for Sante Fe District (with some chance of sampling points being located within KR).

Health: The National Statistics Office has health data for Nueva Vizcaya Province, although the quality of this data is unknown. The Database Management Department of NAMAIA (through the UNDP funded 'Philippine Land Use and Land Cover Change Case Study Project') has health data for Sante Fe District (with some chance of sampling points being located within KR).

Infrastructure: KEF has some data on infrastructure, but of unknown extent and quality.

Community capacity: KEF has some data on community capacity, but of unknown extent and quality.

3.4 Recommendations for Kalahan

No	Recommendation	Action
	Climate	
6	Longer-term time series data should be gathered from the nearest official weather station (maybe Santa Fe) to establish how representative the data from Imugan are (i.e. are they relatively normal climate years?).	KEF should pursue this (estimated time of 0.5 person days).
7	More comprehensive climate surfaces should be generated for the KR using interpolation techniques such as those provided in the BIOCLIM software package (Centre for Resources and Environmental Studies at the Australian National University). The software generates climate surfaces based on the extrapolation of point-source climate data according to known relationships between climate and elevation.	RUPES should fund this through the proposed SINSS project (estimated time of 5 person days).
	Topography	

No	Recommendation	Action
8	Contact Joaquin Borja (email: jackborja@edsamail.com.ph) from Cartography Division, Mapping Department, NAMAIA to determine the progress of the digitizing of the San Nicolas map sheet.	RUPES should pursue this (estimated time of 0.5 person days).
9	Otherwise, RUPES should digitize the relevant area of the San Nicolas map sheet (RUPES has one copy) and generate a digital terrain model (DTM) for the required landscape modeling activities.	RUPES should fund this through the proposed SINSS project (estimated time of 10 person days).
	Geology	
10	KEF and RUPES should obtain a copy of the relevant geology map sheet and technical report (Geology and Mineral Resources of Nueva Vizcaya Province, RI No. 74) as it will be an important reference for soil mapping.	RUPES should fund this through the proposed SINSS project (estimated time of 0.5 person days).
	Soil	
11	KEF and RUPES should map soils for the KR. This is essential for any landscape and hydrology modeling activities that require detailed data on soil depth, texture and structure. Any 'downscaling' of existing regional scale soil data should be avoided.	RUPES should fund this through the proposed SINSS project (estimated time of 10 person days).
	Land evaluation	
12	KEF and RUPES should map land capability and land erosion for the KR. Such data is essential for assessments of land use impact on environmental services.	RUPES should fund this through the proposed SINSS project (estimated time of 10 person days).
	Forest	
13	RUPES should arrange for KEF to be assisted by an independent forest inventory specialist to help quantify rates of carbon sequestration. Independent endorsement of KEF inventory procedures will be necessary to provide the evidence needed to facilitate potential rewards for carbon sequestration.	RUPES should fund this through the proposed SINSS project (estimated time of 5 person days).

No	Recommendation	Action
14	Independent analysis of land cover change should be undertaken in conjunction with ***R.13*** to help validate KEF reforestation activities. Low-cost Landsat images from 1995-1997 may be available through the Database Management Department of NAMAIA (resulting from the UNDP funded 'Philippine Land Use and Land Cover Change case Study Project'). Contact Veneracion Reynoso (verereynoso@yahoo.com). Note that this project collected a range of thematic data for the Upper Magat Watershed (of which the KR covers about 1%).	RUPES should fund this through the proposed SINSS project (estimated time of 15 person days).
	Biodiversity	
15	KEF should continue with their biodiversity baseline survey and monitoring activities, as documented in the RUPES Work Plan.	KEF should pursue this (estimated time of 20 person days).
	Water	
16	KEF should install stream flow and turbidity monitoring stations at the downstream end of the Nasiaan River (eastern zone) and Pampang River (western zone), as documented in the RUPES Work Plan.	KEF should pursue this (estimated time of 10 person days).
	Satellite imagery	
17	KEF and RUPES should obtain high quality satellite images (most likely Landsat TM) from the earliest possible date (early 1980's) through to 2003. Such images will be needed to support the quantification of KEF reforestation activities and other land cover and land use changes.	See recommendation 14.
	Land cover	
18	KEF and RUPES should collect spatial data on land cover from satellite images and fieldwork. This is an important baseline dataset for landscape and land use modeling and monitoring.	See recommendation 14.
	Land use and management	
19	KEF and RUPES should collect spatial data on land use and management. This is an important baseline dataset for monitoring the impact of land use change on environmental services.	RUPES should fund this through the proposed SINSS project (estimated time of 15 person days).
	Land tenure	

No	Recommendation	Action
20	While useful in some situations, spatial data on land tenure is probably not necessary under the proposed RUPES model for the KR (as benefits/rewards will be channeled into community services administered by KEF, not to individual land managers).	None
	Population	
21	KEF and RUPES should obtain all relevant population data for KR.	RUPES should fund this through the proposed SINSS project (estimated time of 3 person days).
	Household income, expenditure and poverty	
22	KEF and RUPES should obtain all available household income, expenditure and poverty data for KR and assess the quality for monitoring purposes.	RUPES should fund this through the proposed SINSS project (estimated time of 3 person days).
23	Otherwise, KEF and RUPES should undertake a strategic household income, expenditure and poverty survey in KR to establish a baseline for future monitoring (of the impact of any implemented ESRS).	RUPES should fund this through the proposed SINSS project (estimated time of 15 person days).
	Education	
24	KEF and RUPES should obtain all relevant education data for KR, as a baseline for future monitoring.	RUPES should fund this through the proposed SINSS project (estimated time of 3 person days).
	Health	
25	KEF and RUPES should obtain all relevant health data for KR, as a baseline for future monitoring.	RUPES should fund this through the proposed SINSS project (estimated time of 3 person days).
	Infrastructure	
26	KEF and RUPES should obtain all relevant infrastructure data for KR, as a baseline for future monitoring.	RUPES should fund this through the proposed SINSS project (estimated time of 3 person days).
	Community capacity	
27	KEF and RUPES should obtain all relevant community capacity data for KR, as a baseline for future monitoring.	RUPES should fund this through the proposed SINSS project (estimated time of 3 person days).

3.5 Data Availability for Kulekhani

Climate: ICIMOD has national scale seasonal climate surfaces for Nepal (National Climate Atlas), based on 1985-1990 data. BIWMP have more detailed data for the KW, possibly from a network of weather stations.

Topography: WN and RUPES have one copy of the four 1:25,000 topography map sheets that cover the KW (Sheet name: Bhimphedi, Sheet number: 278505D, Contour interval: 20 meters; Sheet name: Bhaise, Sheet number: 278505C, Contour interval: 20 meters; Sheet name: Thankot, Sheet number: 278508B, Contour interval: 20 meters; Sheet name: Tistun-Palun, Sheet number: 278505A, Contour interval: 20 meters). The map sheets are available in digital form (including a DTM) through BIWMP, however the quality of digitizing is unknown.

Geology: BIWMP has 1:250,000 geology data (hard copy and digital) for the KW.

Soil: BIWMP has 1:50,000 soil data for the KW, based on 1978/79 aerial photography and field survey (supported by the Canadian Assistance Program in 1984). ICIMOD also has this data.

Land evaluation: BIWMP has 1:50,000 data on land systems, land capability and erosion potential for the KW, based on 1978/79 aerial photography and field survey. ICIMOD also has this data. The land systems data appears to be of high quality, but the land capability and various erosion potential datasets are based on dated methods and poor assumptions. BIWMP, ICIMOD and DSCWM have a number of reports from erosion and sedimentation studies in the KW.

Forest: BIWMP has 1:50,000 vegetation data for the KW, although the quality of this data is unknown.

Water: BIWMP and NEA most likely have seasonal stream flow and turbidity data from gauging stations with the KW, although the type and quality of data is unknown.

Satellite imagery: BIWMP has a variety of Landsat TM images for KW. Other images are available through the normal range of national and international suppliers.

Land cover: BIWMP has relatively recent (date unknown) 1:50,000 land cover data for KW, although the quality of data is unknown. ICIMOD has 1:50,000 land cover data from 1978/79.

Land use and management: BIWMP and ICIMOD have no spatial data on land use and management and there is no useful data at provincial or national scales.

Land tenure: BIWMP has land tenure data for KW, although the resolution and quality of data is unknown. Results from the 2001 Census Mapping Project may also be useful, at least at a VDC level.

Population: BIWMP has data on population totals, density and migration, although the resolution and quality of this data is unknown. Any data derived from the 2001 Census Mapping Project should be of reasonably high quality.

Household income, expenditure and poverty: BIWMP has some data on household income, expenditure and poverty for KW, although the resolution and quality is unknown. ICIMOD has provincial scale data for contextual purposes (with some chance of sampling points being located with KW).

Education: BIWMP has some data on education services and levels of literacy for KW, although the resolution and quality is unknown. ICIMOD has provincial scale data for contextual purposes (with some chance of sampling points being located with KW).

Health: BIWMP has some data on health services for KW, although the resolution and quality is unknown. ICIMOD has provincial scale data for contextual purposes (with some chance of sampling points being located with KW).

Infrastructure: BIWMP has a good data on infrastructure.

Community capacity: BIWMP has some data on forest user groups (FUGs) and other community organizations.

NOTE: See Appendix 3 for a partially completed data inventory of the ICRAF-SEA managed RUPES site in Sumberjaya, Indonesia (this would be best completed by Atiek Widayati or Meine van Noordwijk of ICRAF-SEA).

3.6 Recommendations for Kulekhani

No	Recommendation	Action
	Climate	
28	More comprehensive climate surfaces should be generated for the KW using interpolation techniques such as those provided in the BIOCLIM software package (Centre for Resources and Environmental Studies at the Australian National University). The software generates climate surfaces based on the extrapolation of point-source climate data according to known relationships between climate and elevation.	RUPES should fund this through the proposed SINSS project (estimated time of 5 person days).
	Topography	
29	WN should obtain digital data from BIWMP and, in collaboration with RUPES, assess the data quality and suitability for terrain and hydrology modelling.	WN should pursue this (estimated time of 1 person days).
30	RUPES should digitize the four map sheets and generate a DTM.	RUPES should fund this through the proposed SINSS project (estimated time of 15 person days).
	Geology	
31	WN and RUPES should obtain geology data from BIWMP, as it will be an important reference to assess the quality of soil data and to assist any future soil mapping.	WN should pursue this (estimated time of 0.5 person days).

No	Recommendation	Action
	Soil	
32	WN and RUPES should obtain soil data from either BIWMP or ICIMOD. Data quality must be assessed and improved through field sampling, as soil information will be a key input into the required RUPES hydrology and sedimentation studies.	RUPES should fund this through the proposed SINSS project (estimated time of 20 person days).
	Land evaluation	
33	WN and RUPES should obtain land capability and land erosion data and reports from either BIWMP or ICIMOD. Data quality must be assessed and improved through field sampling and digital terrain modeling, as this information will be a key input into the required RUPES sedimentation studies.	RUPES should fund this through the proposed SINSS project (estimated time of 15 person days).
	Forest	
34	WN and RUPES should obtain vegetation data from BIWMP and assess the quality for use in the required RUPES hydrology and sedimentation studies.	WN should pursue this (estimated time of 0.5 person days).
35	WN and RUPES should map forest types and change since 1980 (based on Landsat TM, available through either BIWMP or ICIMOD) for use in the required RUPES hydrology and sedimentation studies.	RUPES should fund this through the proposed SINSS project (estimated time of 10 person days).
	Water	
36	WN and RUPES should obtain seasonal stream flow and turbidity data from BIWMP or NEA, as this information is crucial for the required RUPES hydrology and sedimentation studies.	WN should pursue this (estimated time of 3 person days).
	Satellite imagery	
37	WN and RUPES should obtain high quality satellite images (Landsat TM is the best value) from the earliest possible date (early 1980's) through to 2003. Such images will be needed to validate the extent of reforestation in KW over the previous 20 years and determine what impact this has had on sedimentation processes.	See recommendation 35.
	Land cover	
38	WN and RUPES should obtain all existing land cover data for KW and assess the quality for hydrology and landscape modelling.	WN should pursue this (estimated time of 1 person days).

No	Recommendation	Action
39	WN and RUPES should classify land cover for KW from 1980's and contemporary Landsat images, and determine the extent of land cover change over the previous 20 years.	RUPES should fund this through the proposed SINSS project (estimated time of 5 person days).
	Land use and management	
40	WN and RUPES should collect spatial data on land use and management, through standard survey and mapping techniques. This is an important baseline dataset for monitoring the impact of land use change on environmental services.	RUPES should fund this through the proposed SINSS project (estimated time of 20 person days).
	Land tenure	
41	WN and RUPES should obtain all relevant land tenure data for KW. This is a key dataset for targeting individuals, households and community groups for involvement in any ESRS.	RUPES should fund this through the proposed SINSS project (estimated time of 3 person days).
	Population	
42	WN and RUPES should obtain all relevant population data for KW.	WN should pursue this (estimated time of 1 person days).
	Household income, expenditure and poverty	
43	WN and RUPES should obtain all available household income, expenditure and poverty data for KW and assess the quality for monitoring purposes.	WN should pursue this (estimated time of 1 person days).
44	WN and RUPES should undertake a strategic household income, expenditure and poverty survey in KW to establish a baseline for future monitoring (of the impact of any implemented ESRS).	RUPES should fund this through the proposed SINSS project (estimated time of 20 person days).
	Education	
45	WN and RUPES should obtain all available education data for KW and assess the quality for monitoring purposes.	WN should pursue this (estimated time of 3 person days).
	Health	
46	WN and RUPES should obtain all available health data for KW and assess the quality for monitoring purposes.	WN should pursue this (estimated time of 3 person days).
	Infrastructure	
47	WN and RUPES should obtain all relevant infrastructure data for KW, as a baseline for future monitoring.	RUPES should fund this through the proposed SINSS project (estimated time of 3 person days).

No	Recommendation	Action
	Community capacity	
48	WN and RUPES should obtain all relevant community capacity data for KW, as a baseline for future monitoring.	RUPES should fund this through the proposed SINSS project (estimated time of 3 person days).

4. Requirements for the development of a RUPES SINSS

A well-designed SINSS would facilitate standardized and consistent assessment of RUPES action research sites and outcomes (in relation to landscapes, land use and livelihoods), and promote transparent and informed negotiation between stakeholders involved in the development of ESRSs. It would also establish important research site baselines for spatial targeting, impact monitoring and adaptive management.

The proposed SINNS (see Appendix 2 for a generic concept note) should assist RUPES site implementers and other stakeholders to:

- identify which environmental services are present and how they are distributed across the landscape (baseline ecosystem assessment);
- determine the location of environmental service 'hot spots';
- identify which land uses (intensity, products and practices) are present and how they are distributed across the landscape;
- investigate the spatial and temporal relationships between land uses and environmental services;
- identify where in the landscape land uses are degrading, maintaining and improving environmental services;
- identify the most suitable land management practices to maintain and improve environmental services;
- identify landholder income and expenditure patterns;
- identify social opportunities and constraints with respect to land tenure, demographics, access to services, governance, political marginalization etc;
- identify zones in the landscape (based on environmental, economic and social conditions) where land use change would have an efficient, effective and quantifiable impact on maintaining and improving environmental services; and
- determine the extent of land use change needed to foster the desired maintenance or improvements to environmental services, and the required level of landholder and community participation.

This information would provide the necessary foundation for negotiating ESRSs. It would inform potential 'buyers' of the level of certainty and anticipated return on their investment (through the quantification of environmental services), and it would inform potential 'sellers' (and those not selling) of who would be involved, what they would be expected to contribute, and what rewards they would expect to receive.

Data collection, field survey and analysis for Kalahan and Kulekhani (combined) would require roughly 200 person days. Further sites would require, on average, 100 person days. The development of spatial assessment and targeting methods (modelling and evaluation components of the SINSS) would require approximately 150 person days. Operational costs such as data purchase, travel and fieldwork would require roughly USD10K per site.

While external funds have been sought for the design and development of a SINSS for the RUPES Program, the time lag associated with the project development cycle means that funds will not be available until at least the start of 2005 (assuming future proposals are successful). This funding and time gap poses a problem for RUPES as the type of information proposed for the SINSS is critical to the early stages of any ESRS process.

Recommendation 49: RUPES should consider funding one of the following options (at least for the first year while other funding sources are sought).

?? Development of a partnership with an organization that can commit experienced personnel to the development of a SINSS based on fieldwork at three RUPES research sites (estimated total cost: USD250K).

?? Employment of a field survey and spatial information specialist for a two-year period to design and develop a SINSS based on fieldwork at three RUPES research sites (estimated total cost: USD150K).

?? Support of a PhD candidate to design and develop a SINSS through a two-year period of doctoral research at three RUPES research sites (estimated total cost USD70K). This option has been explored with the Centre for Resource and Environmental Studies at the Australian National University, and has the full support of the Director (Professor Bob Wasson).

Appendix 1: Institutional collaboration

The following is a summary of institutional contacts made on behalf of RUPES in Bangkok, Kathmandu and Manila. Given the presence of ICRAF in the Philippines, only limited time was spent searching for data and no contact was made with potential donors. Conversely, given the absence of ICRAF in Nepal, considerable time was spent searching for data and meeting with potential partners and donors.

National Mapping and Resource Information Authority (NMRIA)
Manila (Makati)
Contact: Joaquin Borja, Officer in Charge, Cartography Division
Telephone: + 632 810 4831
Email: jackborja@edsamail.com.ph
Discussion: Joaquin is the head of the Cartography Division, which is steadily digitizing all 1:25,000 topography maps for the Philippines. After discussions about the Kalahan site, he agreed to 'investigate' fast tracking the digitizing of the relevant map sheet. He suggested that this may be complete by the end of 2004.
Follow-up: A thank-you email was sent in late November 2003, explaining that RUPES would stay in contact over the next year.

National Mapping and Resource Information Authority (NMRIA)
Manila (Makati)
Contact: Veneracion Reynoso, Database Management Department
Telephone: + 632 810 5460
Email: verereynoso@yahoo.com
Discussion: Veneracion coordinated the UNDP funded Philippine Land Use and Land Cover Change Case Study Project, which focussed on the Upper Magat Watershed (of which KR is part). The project developed a large spatial database that includes Landsat TM images and interpretations of land cover change. This data would be useful to KEF and RUPES for contextual purposes. The project also collected detailed socio-economic data for Sante Fe District.
Follow-up: In due course, an ICRAF-Philippines staff member should make contact with Veneracion to obtain the spatial and socio-economic data relevant to KEF activities.

Food and Agriculture Organization of the United Nations (FAO)
Regional Office for Asia and the Pacific, Bangkok
Contact: Thomas Enters
Telephone: +662 697 4000
Email: Thomas.enters@fao.org
Discussion: Thomas completed his PhD in the quantification of environmental services in Thailand. He also has some experience with RUPES and participated in the inception workshop. We discussed ideas about the direction of RUPES and he emphasized the view that quantification of environmental services was not considered enough in the RUPES Design Document or inception workshop, and this was a constraint to the program. He made special reference to the suitability of southern China for a RUPES site. Future collaboration between RUPES and FAO remains unclear, despite the obvious overlaps.
Follow-up: A thank-you email was sent in late November 2003, introducing the idea that Thomas and the RUPES Program Manager should meet to resolve outstanding issues at the next available opportunity.

The World Conservation Union (IUCN)
Asia Regional Office, Bangkok
Contact: Andrew Ingles, Regional Group Head for Ecosystems and Livelihoods
Telephone: +662 6624961
Email: ingles@iucnt.org
Discussion: Andrew was involved in the initial RUPES design process, led by FAO. He currently leads IUCN's limited involvement with RUPES through scoping studies in Sri Lanka and Laos. He is positive about the RUPES concept, but needs to spend time with the RUPES Program Manager to resolve outstanding issues. He provided useful contacts for potential partners, donors and sources of information in Nepal.
Follow-up: A thank-you email was sent in late November 2003, introducing the idea that Andrew and the RUPES Program Manager should meet at the next available opportunity to discuss possible expansion of IUCN's involvement with RUPES.

International Centre for Integrated Mountain Development (ICIMOD)
Kathmandu
Contact: Lies Kerkhoff, Associate Agroforestry Expert
Telephone: +977 1 5525313
Email: ekerkhoff@icimod.org.np
Discussion: Lies is a Dutch APO specializing in agroforestry. We met three times to discuss potential collaboration between RUPES and ICIMOD in the areas of data exchange and technical support. She was very helpful and should be the first point of contact for further discussions between ICIMOD and RUPES, particularly about developing a MOU.
Follow-up: A thank-you email was sent in late November 2003, explaining that the RUPES Program Manager would contact her in the next few months to continue discussions about collaboration between ICIMOD and RUPES.

International Centre for Integrated Mountain Development (ICIMOD)
Kathmandu
Contact: Roger White, Manager PARDYD
Telephone: +977 1 5525313
Email: rwhite@icimod.org.np
Discussion: Roger is the manager of the ICIMOD People and Resource Dynamics Project. This project has collected and analyzed very detailed data for watersheds in Nepal, India and China. It offers useful information on technical methods of watershed analysis that are relevant to Nepal. One of the research areas, the Jhikhu Khola Watershed, is close to Kulekhani and has data that could be extrapolated under different scenarios. There are numerous publications and a CD that describes work in Jhikhu Khola. Roger was very positive about RUPES and encouraged further collaboration with ICIMOD.
Follow-up: A thank-you email was sent in late November 2003, explaining that the RUPES Program Manager would contact him about possible ICIMOD contribution to the watershed analysis work in Kulekhani.

International Centre for Integrated Mountain Development (ICIMOD)
Kathmandu
Contact: Gabriel Campbell, Director General
Telephone: +977 1 5525313
Email: gcampbell@icimod.org.np

Discussion: Gabriel and I had a brief discussion at an ICIMOD dinner. He had heard of RUPES and is keen to discover more about the program. He explained that ICIMOD is starting to research environmental service reward schemes and that collaboration with RUPES would be useful.
Follow-up: A thank-you email was sent in late November 2003, explaining that the RUPES Program Manager would contact him in the next few months to continue discussions about collaboration between ICIMOD and RUPES, leading to the development of a MOU.

Winrock International - Nepal
Kathmandu
Contact: Shyam Upadhyaya, RUPES Site Manager
Telephone: +977 1 4467087
Email: supadhyaya@winrock.org.np
Discussion: Shyam is the leader of the RUPES project in Kulekhani. We spent close to two weeks together in Kathmandu and Kulekhani, attending meetings with potential partners and donors. His efforts to arrange meetings through the Kathmandu network were outstanding and RUPES is fortunate to have him involved. He will follow up with USAID and DFID about potential funding sources for the Kulekhani research.
Follow-up: A thank-you email was sent in late November 2003, explaining that he should email any proposed revisions to the RUPES Work Plan to the RUPES Program Manager for approval.

Natural Resources Management Sector Assistance Program (Danish Funded)
Department of Soil Conservation and Watershed Management, Kathmandu
Contact: Keshar Man Sthapit (Senior Program Advisor) and Lars Jacobsen (Senior Advisor)
Telephone: +977 1 255201
Email: nepdkwmp@mos.com.np
Discussion: Keshar and Lars are both well-respected soil conservation and watershed management specialists in Nepal. They have developed methods to prioritize sub-catchments for soil conservation work and have conducted soil erosion studies in Kulekhani. Both were interested in RUPES, but expressed concern about the need for considerable research to quantify the sources and causal processes of sediments entering KR. They offered further collaboration and advice for WN and RUPES as necessary.
Follow-up: A thank-you email was sent in late November 2003, explaining that WN would keep them informed about the progress of RUPES in Kulekhani.

Resources Himalaya
Kathmandu
Contact: Pralad Yonzon, Team Leader
Telephone: +977 1 537502
Email: habitat@resourceshimalaya.org
Discussion: Pralad is an internationally respected biodiversity specialist who is an authority on biodiversity assessments and conservation planning. He is also well connected in the Kathmandu network. His organization has good capacity for spatial survey, analysis and planning. He was interested in RUPES and will continue collaboration with WN as needed.
Follow-up: A thank-you email was sent in late November 2003, explaining that he should keep in contact with WN.

Bagmati Integrated Watershed Management Program
Kathmandu
Contact: Khruschev Shrestha, National Co-Director

Telephone: +977 1 246763
Email: khruschev@biwmp.com.np
Discussion: Kruschev is the Nepalese head of BIWMP. While BIWMP has been donor supported for nearly 20 years, the last phase (EU funded) has just finished. The Department of Soil Conservation and Watershed Management are now subsuming the project outcomes and staff. With some hesitation, Kruschev provided details on the work that BIWMP has completed in Kulekhani. This includes biophysical, social and economic data compilation and survey and various erosion and sedimentation studies. We discussed how WN and RUPES selected the Kulekhani research site based on the availability of BIWMP data. However, Kruschev explained that the Department may have unfavorable policies towards data exchange and sales without a formal MOU with WN and RUPES. The issue still has to resolved through negotiation between BIWMP and WN.
Follow-up: A thank-you email was sent in late November 2003, explaining that access to the donor-funded data was critical to the success of RUPES research in Kulekhani and that WN and BIWMP should continue negotiations.

Nepal-Australia Community Resource Management and Livelihoods Project
Kathmandu
Contact: Frans Arentz, Team Leader
Telephone: +977 1 5524725
Email: frans@nacrmp.wlink.com.np
Discussion: Frans is the current team leader of one of the most successful community forestry projects in Nepal (that has been running for 30 years), and former academic from the Australian National University. We discussed project research on watershed hydrology and erosion and possible ways to incorporate the results of that research into the Kulekhani work. We also discussed more conceptual issues related to RUPES in Nepal. He is happy to collaborate with RUPES in any relevant areas.
Follow-up: A thank-you email was sent in late November 2003, explaining that WN and RUPES will stay in contact as the Kulekhani project develops.

Food and Agriculture Organization of the United Nations
Kathmandu
Contact: Kazuyuki Tsurumi, FAO Resident Representative in Nepal
Telephone: +977 1 5523239
Email: kazuyuki.tsurumi@fao.org
Discussion: Kazuyuki is the head of FAO in Nepal. We had a good discussion about RUPES and he was keen to learn more about progress in other countries as well. He encouraged the next RUPES visitor in Nepal to meet and brief him on progress.
Follow-up: A thank-you email was sent in late November 2003, explaining that the RUPES Program Manager would contact him before the next visit of RUPES staff to Nepal.

United States Agency for International Development (USAID)
Kathmandu
Contact: Peter Kresge, Director-General Development Office
Telephone: +977 1 4270144
Email: pkresge@usaid.gov
Discussion: We had a good meeting with Peter and two USAID advisors (Charla Britt and Bigyan Acharya). We discussed the broader RUPES Program and specific activities in Kulekhani, and how this overlaps with some of USAID's programs in Nepal. A SINSS concept note and RUPES brochures were left with them for further review. Peter encouraged further discussion and collaboration with WN.

Follow-up: A thank-you email was sent in late November 2003, explaining that WN would maintain contact with USAID to explore funding and collaboration possibilities.

Department for International Development (DFID)
Kathmandu
Contact: Shailendra Thakali, Rural Livelihoods Advisor
Telephone: +977 1 5542980
Email: s-thakali@dfid.gov.uk
Discussion: Shailendra is relatively new to DFID. He explained that the Kathmandu office has just finished their five-year plan for development assistance to Nepal. While much of this plan focuses on livelihoods and poverty alleviation, he saw some potential overlap between RUPES and DFID. He asked for more details than what was provided in the SINSS concept note (up to five pages) and promised to circulate this to DFID staff. RUPES and WN should pursue this contact as soon as possible.
Follow-up: A thank-you email was sent in late November 2003, explaining that WN would maintain contact with DFID to explore funding and collaboration possibilities.

Appendix 2: Concept note for the development of a SINSS

Project Title	Matching Landscapes, Land Uses and People to Improve Environmental Services and Livelihoods in Upland Asia
Beneficiary Countries	Philippines, Nepal, Vietnam
Lead Institution	World Agroforestry Centre (ICRAF)
Contact Person	Fiona Chandler World Agroforestry Centre PO Box 161, Bogor 16001, Indonesia Tel: +62 251 625415, Fax: +62 251 625416 Email: f.cahndler@cgiar.org
Proposed Partners	Australian National University (ANU), Winrock Nepal (WN) International Center for Integrated Mountain Development (ICIMOD), Kalahan Education Foundation (KEF)
Project Duration	3 years
Notional Budget	USD 500K

Project Context

This project covers the first component of the Rewarding Upland Poor For Environmental Services (RUPES) Program, established by the World Agroforestry Centre (ICRAF) with seed funding from the International Fund for Agricultural Development (IFAD). RUPES international partners include the Centre for International Forestry Research (CIFOR), World Resources Institute (WRI), World Conservation Union (IUCN), Conservation International (CI) and Winrock International. Website: http://www.worldagroforestrycentre.org/sea/networks/rupes/index.htm

Project Summary

Despite decades of research and development in upland Asia, there are only limited cases where efforts to halt environmental degradation, without detrimental impacts on the livelihoods of local people, have succeeded beyond the timeframe of external facilitation and funding. Such poor longevity demonstrates the need for alternative 'self-sustaining' approaches.

Among the present market-based approaches to environmental management is one that offers good potential to benefit both environments and people. Herein referred to as 'environmental service reward schemes' (ESRSs), this approach relies on the growing demand for (and diminishing supply of) environmental services to create market opportunities where off-site 'users' can reward on-site 'suppliers' for their activities, ideally through a reliable and self-sustaining flow of payments and other incentives. At present, there are few examples of ESRSs designed for complex land uses (with high diversity in intensity, products and practices over small spatial scales) in upland Asia. Yet, subtle changes in land use (i.e. reforestation, soil conservation and riparian restoration) in strategic landscape locations can result in large improvements to environmental services (i.e. regulated hydrological cycles, water filtration, enhanced biodiversity and carbon sequestration).

Before any ESRS can proceed, the potential 'buyers' will need to know the level of certainty and anticipated return on their investment. Likewise, the potential 'sellers' (and those not selling) will need to understand why priority involvement will be directed towards land managers who have the most efficient, effective and measurable impact on improving environmental services. The sellers will also need sufficiently attractive reward packages to secure their long-term involvement. Such requirements cannot be met without the assessment and quantification of land use impacts on environmental services, over space and time. Complex land uses in upland Asia have complex impacts on environmental services, so the development of methods that disentangle these relationships is critical.

This project will produce a set of assessment methods to map, measure and monitor the effect of complex land uses on environmental services. In combination with participatory economic and social assessments, it will then produce spatial targeting methods to identify and prioritize areas that are most suitable for intervention through ESRSs. These methods will be packaged into a computer-based spatial information and negotiation support system (SINSS), designed to promote and facilitate equitable ESRS initiatives between multiple stakeholders.

The assessment methods, targeting methods and NSS will be based on research conducted at 3 sites in Philippines, Nepal and Vietnam. The key activities in each site will be to: (1) determine the spatial and temporal relationships between land uses and environmental services; (2) identify where in the landscape land uses are degrading, maintaining and improving environmental services; (3) identify the most suitable land management practices to maintain and improve environmental services; (4) identify zones in the landscape (based on environmental, economic and social conditions) where land use change would have an efficient, effective and quantifiable impact on maintaining and improving environmental services; and (5) determine the extent of land use change needed to foster the desired maintenance or improvements to environmental services, and the required level of landholder and community participation.

The research sites will cover a wide variety of environment, land use, social and economic conditions across upland Asia, which should ensure that the final outputs are generic and suited for application to other ESRM initiatives in Asia and beyond. Beneficiaries of the project will be the poor landholders (directly) and communities (indirectly) who receive self-sustaining rewards in return for their contribution to improving environmental services (there will be thousands of these poor landholders participating in the RUPES Program alone). Other beneficiaries will be the buyers of environmental services (directly) and communities (indirectly) who will receive more secure long-term access to environmental goods and services. More broadly, the assessment of land use impacts on environmental services, in combination with the targeting of priority intervention zones, will facilitate more efficient and effective environmental management at site and landscape scales.

The project will combine the research skills and experience of ICRAF (i.e. environment, land use and livelihood assessments) and ANU (i.e. digital terrain, landscape process and land use impact models) with the local expertise of national partners in three countries. Outputs will be applied by leading international organizations involved in the development of ESRSs (i.e. WB, GEF, FAO, IUCN, WRI, IIED, CBD, ICRAF etc.) that have recognized the urgent need for methods that quantify and monitor the impact of land uses on environmental services. Many of those organizations are partners in the RUPES Program and will thus have direct access to project outputs. Wider dissemination of outputs will be through the proven ICRAF package of multi-lingual articles, technical papers, briefs and capacity building workshops.

Appendix 3: Data Availability for Sumberjaya (Indonesia)

This inventory is based on a brief review of ICRAF-SEA data for Sumberjaya with Atiek Widayati. Further data may be available from ICRAF-SEA research staff and partners.

Climate: ICRAF-SEA has coarse scale climate data through the 1:250,000 RePPProT database and the 1989 Land Resource Evaluation and Planning Project, although at this scale the data would be insufficient for hydrology and landscape modelling.

Topography: ICRAF-SEA has 1:50,000 topography maps (and course DTM) plus a high resolution DTM derived from air photo stereo pairs.

Geology: ICRAF-SEA has coarse scale geology data through the 1:250,000 RePPProT database and 1989 Land Resource Evaluation and Planning Project.

Soil: ICRAF-SEA has coarse scale soil data through the 1:250,000 RePPProT database and the 1989 Land Resource Evaluation and Planning Project, although at this scale the data would be insufficient for hydrology and landscape modelling.

Land evaluation: ICRAF-SEA has coarse scale land systems and land capability data through the 1:250,000 RePPProT database and the 1989 Land Resource Evaluation and Planning Project.

Forest: ICRAF-SEA has no data on forest structure, floristics or growth rates.

Water: ICRAF-SEA has some data on stream flow and turbidity (of unknown extent and quality).

Satellite imagery: ICRAF-SEA has Landsat MSS imagery (1973, 1986), Landsat TM imagery (2000), Ikonos imagery (2000), and air photos (1993).

Land cover: ICRAF-SEA has land cover data from interpretation of 2000 Ikonos imagery, and 'land use' (but effectively land cover) data from 1970 (1:100,000), 1985 (1:25,000), 1990 (1:25,000) and 1994 (1:25,000). Some of these datasets are of unknown quality.

Land use and management: ICRAF-SEA has some spatial data on land use and management (of unknown extent and quality).

Land tenure: ICRAF-SEA has some land tenure data (of unknown extent and quality).

Population: ICRAF-SEA has some population data (of unknown extent and quality).

Household income, expenditure and poverty: ICRAF-SEA has some household income, expenditure and poverty data (of unknown extent and quality).

Education: ICRAF-SEA has no education data.

Health: ICRAF-SEA has no health data.